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POWER AND GAS

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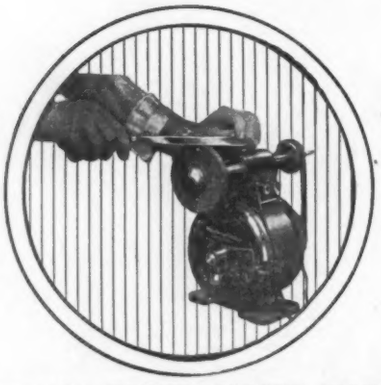

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POWER AND GAS
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VOLUME XXVII SAN FRANCISCO, OCTOBER 21, 1911 NUMBER 17

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POWER POSSIBILITIES IN THE INLAND EMPIRE

BY HARRISON WILLIAMS.

The appellation "Inland Empire" is used locally to designate a portion of the Pacific Northwest that would be more definitely designated as the geographical territory drained by the Columbia river. Few large geographical areas are as definitely marked by natural features as a territorial unit as this is. Nothing could mark such a unit more definitely than the drainage of a great river system. It is a natural economic unit.

The Columbia basin has an area of about 250,000 square miles, that is, the inland part, east of the Cascade range. That is 50,000 more than the area of France, and 40,000 more than that of Germany.

France and 50,000 square miles of adjoining ter-

A Typical Water Fall in the Inland Empire Illustrating the Scores of Small Water Powers to Be Found There.

Rainbow Falls at the Head of Lake Chelan, Chelan County, Washington, West of Spokane.

ritory on the east have a population approximating 60,000,000. Germany now has a population of about 65,000,000 in an area of a little more than 200,000 square miles. Greater Berlin in 1900 contained 2,523,461 inhabitants, and is now estimated to contain 3,400,000. In western Europe the density of population between the 49th parallel and the North Sea and the Baltic averages considerably more than 300 to the square mile.

The average on the portion between the 49th parallel and the Mediterranean is about 190 to the square mile. If we take the 48th parallel as the dividing line both Paris and Vienna will be in the north division, and the disparity will be still greater. No doubt investigation would show that in the matter of commerce and wealth the difference would be much greater, especially in the matter of commerce. Now, industries create commerce and wealth and support population, and we see by these comparisons that industries thrive best in the higher latitudes. Perhaps this is so because the higher latitudes produce "men." Anyway that, for some reason, appears to be the case.

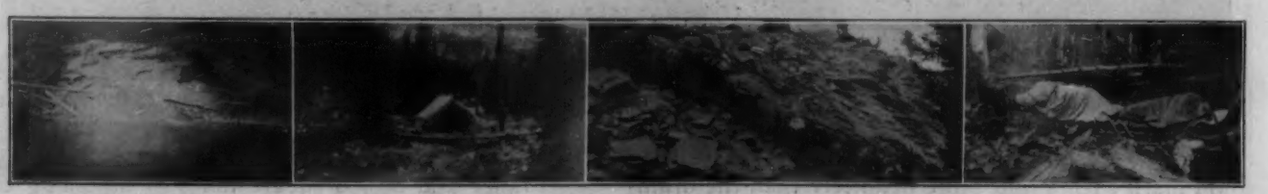
Japan proper has an area of 114,750 square miles, and in 1903 its census gave the population at 45,889,500. Japan is a very mountainous country, and the proportion of its arable land to its unproductive land is not greater if as great as it is in the Inland Empire. Any superiority there may be in productiveness—and there no doubt is superiority now—is due to better husbandry and to fertilizing. More than half of Japan's population is employed directly in agriculture.

Next to the soil itself the streams of the Inland Empire supplying water for power, navigation and irrigation, constitute the greatest natural asset, not excepting the combined mineral and forest wealth. I have seen the statement, said to have been made on the authority of the Geological Survey, that one-third of the water power of the United States is in Oregon and Washington. But there is more water power in the Columbia drainage in Idaho and Montana than there is in Oregon and Washington outside of the Columbia drainage.

The rainfall that produces the great river—two-thirds of it in the State—is the explanation of the fact that the largest body of white pine timber in the United States is in Idaho and the Columbia drainage in Montana. Any attempt to express the value of this water power in terms of money would give only a very meager conception of its importance to the community, since electricity—which can only be put under control by first harnessing the energy residing in some substance, as fuel or falling water—has become a necessity of modern society. But we can best realize its value as a purely economic asset by stating it in money terms.

The horsepower year cost of both water power and steam power takes a wide range, but the ratio is generally placed at 1 to 3. In this Columbia country the difference in cost is easily as much as $25 per horsepower year in favor of water power. That amount on one-third of the water power in the United States, capitalized at 4 per cent, can be expressed only in terms of billions. It is not necessary to go into details, but data regarding one in particular of the great powers here is interesting.

Government engineers reported an average flow in the Pend Oreille River, at Priest River, Idaho, dur-



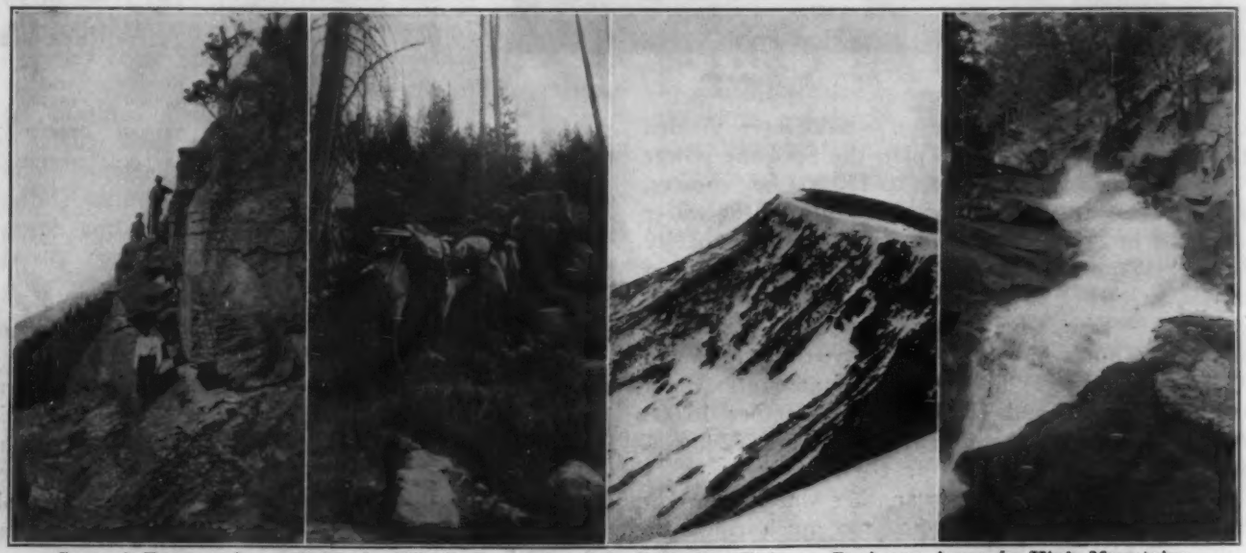
Incidents in Camp Life for the Power Engineer in the Northwest.

Lower Falls in the Spokane River. This Gigantic Power Is Located in the Heart of the Business District of Spokane, Washington.

ing the year 1904 of 28,130 second-feet. This is a very steady stream, the ratio of its maximum to its minimum flow in that year being 12 to 1. Compare that with a few Eastern streams: The Hudson at Mechanicville, N. Y., 80 to 1; the Susquehanna at Harrisburg, Pa., 49 to 1; the James at Buchanan, Pa., 76 to 1; Yadkin at Salisbury, N. C., 51 to 1; the Tennessee at Knoxville, Tenn., 57 to 1; the Merrimac at Garvin Falls, N. H., 30 to 1; the Potomac at Point of Rocks, Md., 168 to 1.

There are three lakes, Flathead, Pend Oreille and Priest, having a possible storage capacity sufficient to maintain a constant flow during the low water months equal to half the average for the year. The drop of the stream between Lake Pend Oreille and the Columbia is 750 feet, mostly within a small part of its course. It will be safe to assume an available fall of 5/6 of the whole fall, that is, 625 feet. The result of a useful effect of 80 per cent of the theoretical horsepower would be the enormous amount of 800,000. The significance of such a water power will be more readily realized by the following comparisons: By the terms of a treaty with Canada only 20,000 second cubic feet of water can be taken from the Niagara River at the falls on the American side. The fall is about one-third as much as the estimated available fall of the Pend Oreille, so the result will be 400,000 horsepower.

A few comparisons of average volume of water power streams will be instructive. The ratio of the average volume of the Pend Oreille to the stream named below is as follows: To the Hudson at Mechanicville, N. Y., 3 to 1; to the Tennessee at Knoxville, Tenn., 2 to 1; to the Colorado at Yuma, Arizona, 2 to 1; to the Missouri at Townsend, Mont., 4.7 to 1; to the Susquehanna (West branch) at Williamsport, Pa., 3 to 1; so the Pend Oreille stands easily at the head of the water power streams of the United States in the matter of commercially available power. When the time comes—as it will sometime, though far in the future in the case of a power so tremendous—that this power is all utilized, the saving of the difference between the cost of this power and steam power will amount to $20,000,000 a year. Besides, the Pend Oreille there



General Topography and Scenic Effects Encountered in Gathering Data on Drainage Areas in High Mountains of the Inland Empire.

are many large water power streams in the Inland Empire. Large drop in a comparatively short distance after the stream has attained to nearly its full size is a feature here. The drop in the Spokane river between Lake Coeur d'Alene and the Columbia is 1224 feet, and in the Kootenai between Lake Kootenai and the Columbia about 400 feet.

I once made a table illustrating a combination of the Chelan and Spokane powers—the 132 feet fall at Spokane Falls—to give both the benefit of Lake Chelan as a reservoir, by harnessing the two into one electrical system. By using all the water at both

Sheep Creep Falls, North of Spokane.

places in 1904 the combination would have yielded 183,470 horsepower. In this plan the Spokane power is supposed to be equipped up to 170,000 horsepower, and when the stream has that capacity hold the water at Chelan in the lake reservoir. When the capacity of the Spokane falls below 170,000 horsepower, bring the Chelan power in for enough to make up the deficiency. In September of that year Spokane would have been supplying 19,404 horsepower and Chelan 150,596 horsepower. In October the amounts would have been 16,428 and 153,572; in November 16,608 and 153,392, and in December 21,228 and 148,772 horsepower.

I doubt whether there is another water power in the United States out of which so much could be made, according to volume and fall, as out of the Chelan power in such a combination. Lake Chelan has sufficient capacity, by cutting a channel at the outlet to draw the water down, to render this plan feasible. It can easily be given the capacity of the Roosevelt reservoir in Arizona, which cost $7,000,000 or $8,000,000. Water power is a perpetual resource, as streams run on forever, whereas coal mines and oil wells, sources of energy, sooner or later become exhausted.

FOR OIL BURNING LOCOMOTIVES, SACRAMENTO DIVISION, SOUTHERN PACIFIC CO.

"Data" for September contains the following interesting statistics relative to oil burning on the Sacramento Division of the Southern Pacific Company's lines:

Class of engine	10 wheel	Consolidation	Mallet consolidation.
Service	Passenger	Freight	Freight
Date of test	May, '08	June, '09	Nov. '09
No. single trips	2	2	2
Time of test	17hr. 39m.	21hr. 23m.	29hr. 2m.
Runnng time	13hr. 55m.	12hr. 59m.	18hr. 11m.
Miles run	315	174	174
Av. st'm pres.	196.0	196.1	194.5
Smoke box tem F.	797	738.5	451.3
Water evap., gal.	44147	48103	91087
Water evap., lb.	367642	400858	759058
Oil burned, gal	3951.6	4328.4	7692.1
Oil burned, lb.	31613	34627	61537
Evap'n lb water per lb. oil	14.14	13.95	15.04
Lb. water evap per sq. ft. heat. surf. per hr.	8.698	8.809	6.392
Lb. oil burned per sq. ft heat. surf.			
No. cars in train	7	14.5	24.5
Weight train tons	342	481	1056
Gross ton mileage	107730	83694	183744
Water evap. per 1000 ton mi., per hr.	0.748	0.761	0.518
gal	409.79	574.75	495.73
Water evap. per 1000 ton mi., lbs.	3413	4790	4131
Fuel oil burned per 1000 ton mi., lbs.	34.90	48.40	39.51
Fuel oil burned per 1000 ton mi., lbs.	279.20	387.20	316.08
Boiler efficiency, %	73.84	72.83	78.52
Max. i. h.p.	1719	1470	2486
Mean i. h.p.	1368	1222	2057
Engine No.	231	2564	4001
Size cyls., in.	22x28	22x30	26 & 40x30
Diam. of drivers, in.	63	57	57
Wt. locomotive lb.	203300	208000	425900
Wt. on drivers, lb.	160000	187000	394150
Wt. of tender, lb.	138070	134745	169765
Heating surf., sq. ft.	2994	3403	6394
Feed water heater, ht. surf., sq. ft.	.....	.....	1221

SAN FRANCISCO BRANCH OF A. I. E. E.

On September 29th the San Francisco Branch of the American Institute of Electrical Engineers held their regular monthly meeting at the Home Telephone Building. The topic for discussion was on Public Service Commissions. Max Thelan, attorney for the California Commission, was introduced as the speaker of the evening by Chairman S. B. Charters. The following were Mr. Thelan's interesting remarks as taken from the stenographic report:

PUBLIC SERVICE COMMISSIONS.

BY MAX THELAN.

I shall proceed to make a few introductory remarks as to the history of the movement in this country; after having done that, take some representative commission—possibly the Wisconsin Commission—and show somewhat in detail just how that commission does its work; then suggest a few of the most interesting problems in connection with this regulation of public service corporations, and then possibly at the end say a few words corncerning what it is proposed now to do in the State of California.

The regulation of public service corporations first took the form of regulation of railroads—and generally of steam railroads; and we find that the first act conferring any power of State control over a public service corporation in this country was an act passed by the General Court or Legislature of Massachusetts in the year 1864. The effective control, however, under that act did not begin until the year 1869, when the Railroad Commission of Massachusetts started its splendid work under the chairmanship of Charles Francis Adams. The Massachusetts commission did not have the authority to fix rates—it simply had power to recommend. During all these years up to the spring of this year the Massachusetts Commission could not fix a rate; but while I was in Massachusetts this summer the General Court, in response to the wishes of Governor Foss, finally conferred upon their railroad commission the authority to fix rates. It was here in California in 1879 that a State Commission was first given the power to fix a rate for a public service corporation; and the public service corporations which were affected here, as the constitution then stood and now stands, are railroads and other transportation companies, but none of the so-called public utilities. Texas followed suit the next year in 1880; and since then almost all the States of the Union have erected some State authority which has control over the rates and generally over the service of at least railroads, and in many cases of other public service corporations. There are only three States in the Union that do not have this kind of control. One of them is Delaware (I suppose that is too small to do anything); another is Utah—which is too firmly controlled by corporations—and the third is Idaho; but in every other State in the Union we have some State authority which can regulate and control the railroad corporations of the State.

Now about public utilities. A distinction is often made between other public service corporations and public utilities, which are considered to include telegraph and telephone companies, gas, light, heat and power companies and water companies. Massachusetts took the first step in this regard also, but it wasn't until 1885. In that year the Gas and Electric Commission of Massachusetts was created. That commission did have power of its own initiative to fix a rate, but did not have power, in case a complaint was made, to investigate the complaint and then to fix the rate. It also has control over stocks and bonds, over service and most kinds of control that any of the State Commissions have today. Although Massachusetts started this control over public utilities in 1885, practically nothing was done by any of the other States until 1907. In that year three of the leading States adopted statutes providing for State control of public utilities. Oklahoma did so in her constitutional convention, New York by statute in response to the message of Governor Hughes, and Wisconsin also by statute in response to the message and the instigation of Governor La Follette. Next year Vermont followed suit, and then Maryland in 1910, and finally, in the spring of this year, we find the legislatures of quite a number of the States passing public utility statutes, giving to a State body—either the Railroad Commission or a Public Service Commission—a control over public utilities analagous to that which was being exercised over railroads.

To show you how general this movement is over the country, I shall mention in passing some of the different States whose legislatures have this year adopted such statutes: New Hampshire and New Jersey in the East; Ohio and Kansas in the Middle West; and Washington, Oregon and Nevada in the extreme West; and the matter is being considered in Colorado, Iowa and other States. I think it must be apparent now that this movement for some kind of regulation and control of the public service corporations of the country is very widespread. It is not confined to any one locality or any one kind of State. We find Massachusetts, the most conservative of all the States of the Union, leading in it, and Nevada, one of the most radical, coming in line today. We find New York, one of the richest States, if not the richest State in the Union, having what is one of the very best public service commissions of the country; and we find that Wisconsin, which is generally regarded as a progressive State, doing probably the very best work of all.

Now a word as to the actual form that these statutes take, and particularly those which I have last referred to, those which were enacted this year, and those enacted in 1907 in Oklahoma, New York, Wisconsin.

Those statutes generally provide that a State Commission shall have power to regulate and control all kinds of public service corporations—not merely railroads but public utilities as well. The statutes generally provide that these bodies shall have the power to fix a rate; that they shall have the power to control service and facilities; that they shall have power to control the issue of stocks and bonds, and some of them provide that the State Commission must first give its consent before any utility or public service corporation can start operations. This last feature has been worked out in its most complete form in the State of Wisconsin in what is known as the indeterminate permit. An indeterminate permit is simply a provision to the effect that if a public utility of a certain kind, such as a gas plant, is operating within a municipality, and has consented that its franchise become indeterminate, then no other utility of the same kind, that is, no second gas plant, can come in unless the State Commission certifies that public convenience and necessity (that is where we get the term "Certificates of public convenience and necessity"), require that the second company shall come into the

field. The object of such provision is two-fold. In the first place, it is to prevent ctt-throat competition, where there is no sense and no need for it. In the second place there is a further provision in connection with the indeterminate franchise, and that is this, that in return for those privileges which are granted to the corporations that are already in the field they must consent that the municipalities may purchase them at a fair price. Now that is fair to the cities and it is fair to the companies as well. That, I think is the most advanced step that has been taken yet by any of the States in the regulation and control of public service corporations, and it is one that the corporations themselves are very largely in favor of; and we find the opposition to this provision not so largely from the public service corporations as from people of ultra-radical views, who want all the competition they possibly can have, even if it is cut-throat competition, thinking that the public will ultimately be best served in that way.

There are some problems in connection with public service corporation control which are of very great interest; and I find that very few, if any, of the State Commissions of the country have reached a solution of these problems which is satisfactory to them or to anybody else. One of the most important of these problems is the questions of what shall be the basis for fixing a rate? Assuming that you have a State Commission which has authority to fix a rate, on what property shall that corporation be given a return? Now we have had many bases suggested. It has been suggested that the original cost of the property plus additions and improvements should be the basis. Again, it has been suggested that the present cost of reproducing the property should be the basis. Again, it has been suggested that the present cost of reproducing the propery less the depreciation should be the basis. Again, it has been suggested that the stocks and bonds should be the basis. Again, it has been suggested that in determining the basis we must consider not only all these elements, but also such elements as give to a corporation a peculiar going concern value. For instance, with a railroad the density of population through which a railroad moves is an important element, and also the possibility of doing business because of its particular location, as against another railroad which may have cost exactly the same amount of money, but which may be located in a community which does not have many resources, so that its opportunities for earning profits are less. These questions have assumed particular importance because of the decisions which have recently been rendered in some railroad rate cases, and particularly the decision of Judge Sanborn in Minnesota. Judge Sanborn, in the Minnesota rate case, used as a basis the cost of reproduction of the property today. He considered nothing else, and he made a finding which found that cost to be about 50 per cent in excess of anything that the testimony showed. I do not state this on my own authority, but I state it on the authority of the Commission of Wisconsin and the Commissions of other States who have looked very carefully into the matter; and naturally the Commissions throughout the Middle West are very much exercised over this decision. The case will be argued in the United States Supreme Court this October; and I feel that a great many of these questions as to what is the proper basis for fixing a rate will be settled by the Supreme Court before the year is over; so that, as to those particular questions we need not have the same difficulty that we have had in the past.

But there are other questions also which are of very much importance, to engineers I think particularly. One of the questions is, how are you going to ascertain the amount of depreciation which is to be charged to operating expenses each year. Very little attention has been given to that question by any of the commissions. Take your other question of depreciation. Suppose you are trying to find the value of the plant, and suppose you take as a basis the cost of reproduction less depreciation, just how are you going to determine that depreciation in ascertaining the value of the plant? I feel a little hesitancy in discussing these questions here, because they are all new in this State, and everyone of them will have to be decided by the present railroad commission, and naturally I do not wish to prejudge the case either for the Commission or myself; and all I can do at present is to indicate some of these interesting problems, and we must trust that this Commission will go at them with intelligence and with thoroughness, and in view of all the light it can get both in this State and other States, so as to try and reach a conclusion which will be intelligent and which will be fair.

There is just one other matter about which I wish to speak, and that is the problem in California.

I think that we are all probably very much interested in how our public utilities are to be controlled in this State; and in dealing with that problem I had better say a word first as to the conditions as they have existed in this State in the past, and then secondly, as to the changes which it is now proposed to make.

It is needless for me in an audience of this kind to say very much about the nature of control which our cities and counties have exercised in the past. You are just as familiar with that doubtless, or more so, than I am. We all know that the cities have had the power to fix the rates of public utility corporations within their boundaries, and that they have had certain police powers, but that, outside of these powers, they had no powers as to service or facilities, unless the franchise which the corporation received from the city specified that such powers might be exercised. For instance, there is no power in a city to force the extension of a gas main unless the gas company, in securing its franchise, should have consented that this power be reserved. No city has had the power to control a stock or bond issue, even of a utility that is entirely within its borders. So much for city control.

As to county control, if I am correct, that control has been exercised chiefly with regard to water companies. The constitution makes it the duty of boards of supervisors to fix water rates, but I am not aware of this power having been exercised as to other utilities.

As to State control, up to the present the State

Board of Railroad Commissioners has been the only State authority which has exercised control over public service corporations other than, of course, our taxing authority. Now this Board has had control simply of railroads and other transportation companies; and in the Market Street Railway case our Supreme Court has decided that this did not include the street railroads; so that the Board has had control over railroad companies, express companies and steamship lines—that is, those steamship lines that did not operate on the ocean. The kind of control that the State Board has had has been two-fold: the power to fix a rate, and the power to establish a uniform system of accounting; that is all—just those two powers. By mentioning those two powers, the constitution by implication has prevented the exercise of any other power; so that, as the constitution stands today it is not possible for the State Board to regulate any question of service or facilities of a railroad company, or to make any order in the matter of the control of stocks and bonds.

What the commission has done these last thirty years seems to have been largely to draw its salary. I understand they were rather regular in this; and I cannot refrain at this point from telling a little incident which happened to me in the State of Washington this summer, and which I have told on several occasions lately on the stump. I went North and East and South this summer to examine the work of the best railroad and public service commissions, in the hope that our Commission here might be guided by the best thought of those men in solving these same problems; and I found in Washington a very brainy lawyer by the name of Fairchild, who is the Chairman of the Washington Public Service Commission. About four years ago, Washington woke up and established a public service commission. Mr. Fairchild came down here to San Francisco in order to learn how railroads were regulated. He had the Constitution of California; knew that we had a Railroad Commission since 1879, and assumed that in the 30 years and over which had passed since then this State must have accomplished great results in the way of the regulation of railroads and other transportation companies. So he came here to San Francisco, and went into the office of the Railroad Commission, and found there one individual, a pretty stenographer, he told me—in fact he said she was very pretty—and he asked her where the Commissioners were. She said she was very sorry, but they were out; so he went away, and in the afternoon he came back again, and repeated his inquiry as to where the Railroad Commissioners were, and the girl hesitated a little while. "Well," she said, "they are out." And he said, "I am Mr. Fairchild. I am from Washington. We have a new public service commission up there, and want to find out how you people have been regulating railroads during the last 30 years." "Well," she said, "I am very sorry, but the commissioners never show up except at the end of the month, when they draw their salaries."

Mr. Fairchild, however, is a persevering sort of a man; he usually gets what he wants; and he thought he would hunt up the Secretary of the Commission, and he finally found him, and he said, "Mr. Secretary, I have come all the way from Washington to find out how to regulate railroads, and I haven's had very good success so far. Now, can't you tell me?" The secretary said, "That is easy enough. All you have to do is to make the people think that everything is all right, and that is all there is to it."

Now that is the way that our railroads have been regulated in this State for the last thirty years. We have absolutely nothing to guide us here by what has been done in California in the past. Those thirty years have been wasted. The people have paid from one hundred and twenty to one hundred and fifty thousand dollars to the Commissioners in those years, and have got nothing for it. What is to be done now? In the first place, the last legislature passed what is known as the Eshleman-Stetson railroad bill. That is a good bill as far as it goes, but at every step the legislature found itself hampered by the provisions of the present constitution. The legislature did the best it could in working out the powers given by the constitution; but the conclusion was borne in upon them—as it must be upon all thinking men in the State—that if we are to follow in the footsteps of the most progressive States in the Union the constitution must be changed, so that our Commission may exercise the powers which are exercised by the Commissions in these other States; and for that reason three constitutional amendments were proposed. I am not going into the details of those amendments unless there should be an inclination later on to learn more of them, except I will state simply in a word or two what each of the three amendments proposes.

First is Assembly Amendment No. 50. That is a simple amendment, and refers simply to the power of the Commission over the rates of railroad companies, and removes certain limitations in the constitution at present. For instance, at present the railroad commission has no power over commutation rates. We can do nothing there. At present there is a long and short haul clause in the constitution which is absolutely rigid—no exception at all. It has never been obeyed, but here comes the present commission which has to obey the law, which intends to obey the law, and it finds what is called the long and short haul clause, which makes it unlawful for a railroad to make a rate for a longer distance lower than for a shorter one in the same direction and over the same route, absolutely, independently of what the conditions may be, even if there is water competition forcing a lower rate for the longer distance than the shorter one. But there stands the constitution. It must be changed, or else the entire railroad system of the State must be revolutionized. What is now proposed is to read into the constitution the same kind of long and short haul clause which is in the Interstate Commerce Law. The clause is there, but power is given to the commission, when conditions justify it, to deviate from it—a sensible conclusion.

There is another innovation in Assembly Amendment No. 50, which gives to a shipper, in case of an excessive or discriminatory rate, the right to appear before the commission instead of having to go through the process of a suit in court.

The next amendment is Assembly No. 6, which

increases the number of commissioners from three to five, because of the extra work which will result from the control over public utilities. It provides also for appointment by the Governor instead of by election by the people. All the commissions of the country which are doing the best work are those that are appointed instead of elected. I found that in New York, Wisconsin, Massachusetts, Washington, and in practically all of the States which have recently adopted railroad or public service commission statutes the commissioners are appointed. The reason is very obvious, because you are much more likely to get trained men and experts on a commission of this kind by appointment than by election. By election you are likely to get three farmers, or three lawyers, or three business men, or three men of leisure as we have had in the past; but by appointment you may get one lawyer versed in railroad law; one man who is versed in accounts and statistics, and one who is versed in practical rate making, as is the case in Wisconsin; or you are likely to get one lawyer who understands railroad law, one man versed in finances, so he can handle the stocks and bonds, and another versed in the practical operation of railroads, as is the case in Massachusetts.

So I think there is no doubt at all that this is a provision in the way of a more intelligent and able board than we have had in the past. But the most important provision in this No. 6 is the one which provides that the legislature can confer upon the State Commission additional powers. This is necessary because of what I pointed out to you, that the constitution at present gives the Commission only the power to fix a rate, and the power to prescribe a uniform system of accounting; so that, in order to secure a regulatory control over the issues of stocks and bonds, and over service and facilities, it is absolutely necessary that these provisions be added. I do not know whether the gentlemen here are very generally in favor of control over stocks and bonds; it may be that some of you are not. Possibly your natural interests would be opposed to that; but the experience of the States of the Union seems to show that that it absolutely necessary, and the great mass of the people, there is no question, are heartily in favor of it. No honest corporation need fear this, but the wildcat corporations fear it, and ought to.

In New York City I found every street railroad is in the hands of the receiver. I tried to find out why, and they told me this: That originally there were a large number of street railroads in the City of New York, and these began to consolidate, two here, three there, and so on; and every time they consolidated they watered the stock and issued an amount of bonds which was in excess of what they had before, with the result that the street railroads today have a large amount of water in the stock and an excessive bond issue, which makes it impossible for them to pay the interest on the outstanding securities. The result is that the people can't get new cars or equipment. There is one eternal fight between the Public Service Commission of the First District and the street railroads, because the Commission is trying to undo to some extent what has been done, and can't make any headway, and the corporations are trying to keep what they have got, and in the meantime the public suffers. I do not think that any public service corporation that sees the tendency of the times can object to a control over stocks and bonds which is exercised by an efficient commission. The honest corporation has nothing to fear, but the wild-cat corporation has, and it ought to; and I am willing to do my part to make the wild-cat corporation fear that sort of thing. That is about all there is to No. 6.

Now the other amendment—which I think is possibly of more interest to you gentlemen than any other—is Senate No. 47. That is the amendment which defines public utilities, and which gives to the State Commission certain kinds of control over certain of those public utilities. Public utilities are defined to include all kinds of railroads, adding street railroads to the present railroads under the control of the Commission; and in addition to those, telegraph and telephone companies, gas, heat and power companies, water companies, canal, pipe-line companies, wharfingers and warehousemen. The amendment provides in the first place that the Commission is not to exercise control over those plants if owned by municipalities. Those municipalities are to continue their regulation in their own way for their own utilities, that is, those which are publicly owned. It provides also that the municipalities are to keep the present powers which they have over privately owned utilities, unless the people, at an election called for that purpose, confer these powers upon the State Commission.

Now this particular provision has been subject to quite a little criticism, and in my opinion it is not the last step in the matter. I think that, possibly with the exception of some of the very largest cities, such as Los Angeles and San Francisco, it would be wiser if the State had the entire control, including the power to fix a rate. The reason for the submission of the amendment in its present form is simply this: Los Angeles has a Public Service Commission of which it is very proud. There is a strong local pride in the city of Los Angeles, and even if they kick out three incumbents now, and three then, and three more some other time, they would never consent, at least for the present, that such power as they have won be taken from them—so that if this amendment had been submitted in the form suggested by some of the men who are affiliated with the public service corporations of this city, namely, that the State should take over the whole power, it would have been defeated. Now the question which confronts us here is simply this, as to whether it would be wiser to submit an amendment which would be defeated, or what amounts to the same thing—defeat the present amendment—or to pass the present amendment. Now to answer that question I think it necessary that we find out just what changes in the existing order of things this amendment will create. In the first place, let me illustrate what I want to say with a rough diagram. Suppose we take this blackboard as representing all the powers of regulation and control which can be exercised by any authority in the State. Now suppose that this triangle in one corner represents

the powers which are at present possessed by the municipalities of the State. Those powers are simply, first, to fix a rate; and secondly, to enact certain police ordinances, such as the power to force a street railroad to put on car-fenders. Those are the only powers that are exercised by any municipality today as to public utilities. Now there is a great residuum in the State. First, there are corporations not subject to any control today, such as the telegraph companies, the power companies, and the pipe-line companies. Those corporations are not subject to any regulatory power today; and if the principle of public regulation is good, it would seem that we should consider very seriously the question of whether we should defeat the amendment, and in that way deprive the public of any kind of regulation and control over these particular corporations. In addition to the corporations I have mentioned, there are telephone companies outside of cities and gas and electric light companies outside of cites. I do not understand that these companies are today subject to public regulation, and as to those companies the entire field of regulatory power—the control of rates, stocks and bonds, extensions and so forth, is open. In addition to that, with reference to the corporations down here (indicating the triangle) which are regulated only in part today by the cities, there is a certain scope of authority which even the cities do not exercise—for instance, the control over stocks and bonds. If this amendment passes, the entire residuum of power here, which is today exercised by nobody as to certain corporations, and which is exercised today by the cities only in part as to other corporations, will be conferred upon the State authority. It seems to me it would be far wiser to take what is offered to us now, although it may not be perfect, and then work out the remaining portion of the problem later. Just to take a homely illustration, I think it is better to take the three-quarters of the loaf that is offered to us today rather than take no loaf at all. We have no assurance that any future legislature within a reasonable time would submit the kind of amendment which some of you gentlemen possibly think ought to be submitted; and if it were submitted we have no assurance that it would not be defeated by a combination between Los Angeles and San Francisco. So I think that most of us who really thoroughly believe in the principle of public regulation and control will be in favor of this amendment, although it has defects. I say that frankly. It has defects, but I think its defects are insignificant as compared with its advantages.

That is about all that I had to say. These problems are extremely difficult, and they are problems which call for co-operation. The State Commission will, of course, go ahead, even if it does not get any help from any of the public service corporations. From what I know of the State Commission today, it will go ahead to perform its duty. It owes a duty to the public and to the corporations also, and it will perform that duty; but it can perform it far more wisely and efficiently if it has the co-operation of the men who represent the public service corporations of the State; and I feel from what many of them have told us that we will have the hearty co-operation of at least most of the corporations. I hope that we may attain the same results which have been attained in Wisconsin. In Wisconsin the public service corporations are now very strongly in favor of the State Commission. Of course that is partly because of the splendid, thorough, scholarly work which that Commission has done—a work which has resulted very largely from its association with the University of Wisconsin. Graduates of the State University bring to the Commission a scholarliness and thoroughness and an unprejudiced view which have resulted very largely in the efficient work of the Commission. I should like to see that same kind of work done here in this State, and I think it will be, and I hope that in that work we may have the help of the public service corporations themselves.

IRON LOSS IN THE CURRENT TRANSFORMER

Some interesting conclusions have been recently reached by the Bureau of Standards in a series of tests performed in a study of the current transformer with particular reference to the socalled iron loss. The conclusions are nine in number and are as follows:

1. While the ratio of transformation of current transformers usually decreases with increasing current, it may increase in individual cases, or even pass through a maximum.

2. The ratio and the phase angle performance may be accurately computed from the magnetic data of the core.

3. In general the slope of the ratio curve may be qualitatively predicted from the value of the Steinmetz exponent if the latter be assumed to be constant. But the iron losses, particularly at the low flux densities used, depart too widely from such a simple law for accurate work.

4. The slope of the ratio curve may be accurately computed from the slope of the curve obtained by plotting the core loss against the flux on logarithmic coordinate paper.

5. It is proposed that this logarithmic slope, or logarithmic derivative shall be called the ratio of variation. It is much more useful than the actual exponent.

6. The methods now in use for determining the "exponent" fail to give a true exponent that will satisfy the equation $W = WB^z$, unless z is a constant. The quantity actually determined by these methods is the ratio of variation.

7. The wave form of the secondary of a current transformer may be considered to be the same as that of the primary current for even the most precise measurements, as the distortion within the transformer is entirely negligible.

8. While the effect of variations in wave form on ratio and phase angle may be detected by accurate measurements, it is too small to be of practical importance, being of the same order of magnitude as the effect of small changes in frequency.

9. The null methods used for accurate determinations of ratio and phase angle all give the theoretically correct results, well within the experimental error, so that the accuracy attainable is decidedly greater than is required in practice.

RELATION BETWEEN WEIGHT AND OUTPUT OF INDUSTRIAL MOTORS.[1]

Part II.

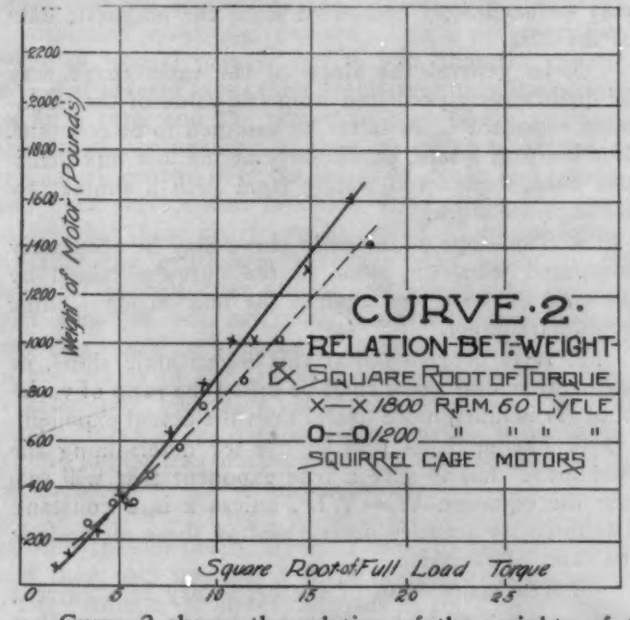
Induction Motors.

The weights given in the accompanying tables are commercially called "Frame Weights." Two machines built on the same frame will have the same frame weight. For instance, the 5 and 7½ h.p. eight-pole motors are built upon the same frame and hence are given the same weight commercially, although the actual weight of the 7½ h.p. motor would be somewhat more, and the actual weight of 5 h.p. motor somewhat less than the value given in the table. This fact causes the irregularities shown on the curves. The square roots of the torque are figured from the torque obtained by using full load horsepower and synchronous speed. The latter is used for convenience.

TABLE 3. SQUIRREL CAGE INDUCTION MOTORS, 60 CYCLE, 110, 220 AND 440 VOLTS.

RATINGS AND WEIGHTS.

	4 Pole.		6 Pole.		8 Pole		10 Pole		12 Pole	
1	17.1	75	....	....	....	...	....	...	....	...
2	2.42	120	2.94	170	....	...	....	...	....	...
3	2.94	170	3.48	230	....	...	....	...	....	...
5	3.86	230	4.68	345	5.4	470	6.04	580	6.62	740
7½	4.68	340	5.73	345	6.62	470	7.40	580	8.1	740
10	5.4	340	6.62	470	7.65	580	8.55	740	9.36	860
15	6.62	513	8.1	580	9.36	740	10.40	860	11.4	1135
20	7.65	634	9.36	740	10.8	740	12.1	860	13.2	1135
30	9.35	834	11.4	860	13.2	860	14.8	1135	16.2	1415
40	10.8	1013	13.2	1013	15.3	1135	17.1	1135	18.7	1415
50	12.1	1012	14.8	1307	17.1	1415	19.3	1415	20.9	1870
75	14.8	1307	18.1	1415	....	....	....	....	....	....
100	17.1	1611	20.9	2211	....	....	....	....	....	....

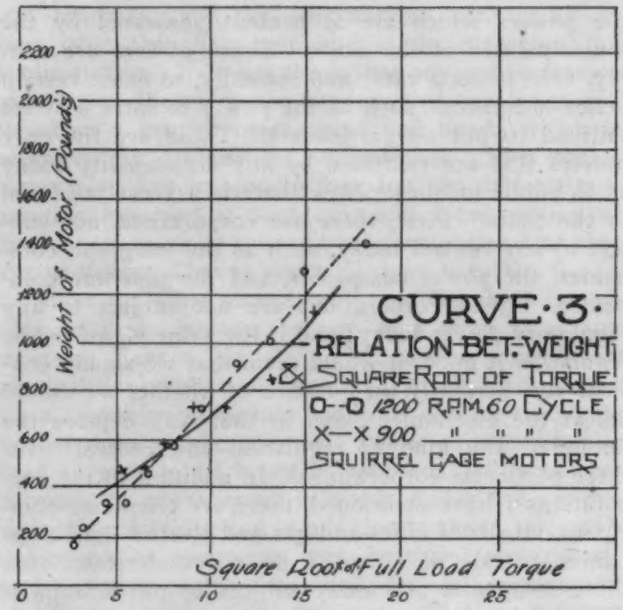


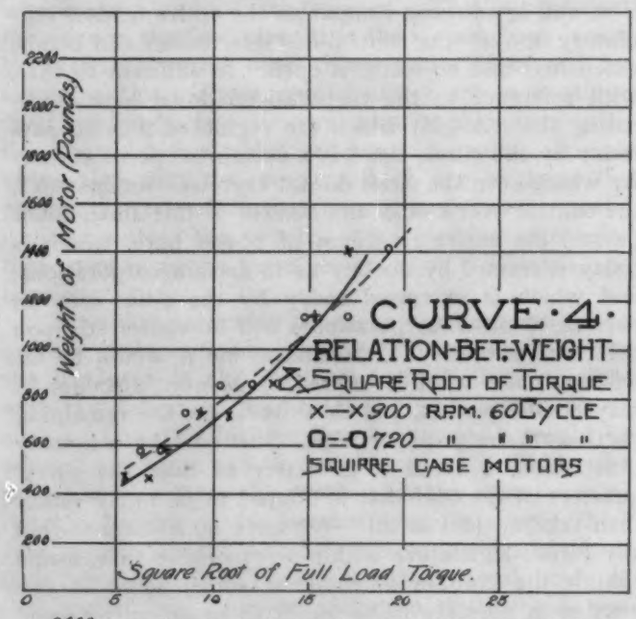
Curve 2 shows the relation of the weights of 4 pole and 6 pole motors to square roots of torques. At the lower ratings 4 pole motors are lighter for same torque than the 6 pole motors, but are heavier on ratings above square root of torque equal to 6.

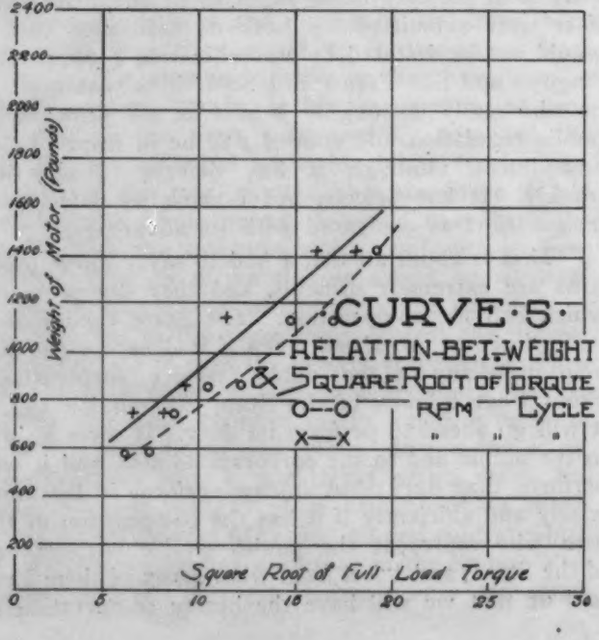
Curve 3 shows relation weights of 6 and 8 pole 60 cycle induction motors. Note that above square root of torque equal to 8, the 8 pole motors are lighter for same torque than 6 pole motors.

Curve 4 shows that curves representing weights of 8 and 10 pole motors cross at value of square root of torque equal to 15.5.

[1]Continued from issue of October 14 1911.







Curve 5 shows that within range of ratings given the 12 pole motors are heavier than the 10 pole motors for the same torque. The curves if plotted out to larger ratings will cross at point where the 12 pole motor becomes lighter than the 10 pole motor for the same torque.

The above method of lining up weights afford a convenient method of lining up weights of different types of machines and also shows if any discrepancy occurs in weights of particular machines.

PRIMER OF APPLIED THERMODYNAMICS.[1]
EIGHTH LECTURE.

Feed Water Heaters, Condensers and Injectors.

Although the study of Thermodynamics may be interesting to the student of mathematics simply as a combination of playful symbols enabling him to enjoy that exquisite pleasure known only to those who have entered the inner threshold of this wonderful branch of reasoning, it would never be interesting to the practical engineer could he not apply the fruits of his study to the advancement of the profession.

Having now acquired a ground work upon which to build applications of Thermodynamics we shall find it exceedingly interesting to look into some of the fundamental accessories of the modern power plant.

We have previously seen that an enormous amount of latent heat energy is absorbed in the evaporating of water into steam. When this steam, after use in the engine cylinder is exhausted into the air a large quantity of energy is lost by being put to no useful purpose. It is evident, then, if the exhaust steam could be condensed into water by bringing it in contact with cold water, the cold water would easily absorb the latent heat in the steam, thereby causing the temperature of the cold water to be materially increased. Now if the particular cold water used is that of the feed-water for the boiler, a considerable saving in heat energy is thereby effected, for one B.t.u. is saved for every pound of water raised one degree. A contrivance accompanying this result is known as a feed-water heater. When the steam is brought directly in contact with the water, the heater is said to be of the open type, and when the heat from the steam is absorbed through an intervening medium, it is said to be of the closed type. A typical example of feed-water heaters is the so-called Cochrane Feed-water Heater shown in Fig. 18. This device not only heats the entering water by means of the exhaust steam, but by means of the clever accessories shown in the illustration, the oil which is contained in the exhaust steam is deposited at the oil separator shown in the diagram. The cold feed-water enters from above on the slanting plates as shown and, in trickling down over them, comes in intimate contact with the steam after it has passed the oil separator. Coke is placed in the bottom of the heater, and, as all the water must pass down through this, the water is thereby largely purged of all impurities, and thus assistance is given for maintaining more perfect boiler operation.

[1]A resume[1], devoid of higher mathematics, covering the essentials of a series of lectures now being given by the editor of this Journal before the Senior Mechanical Engineering students at the University of California.

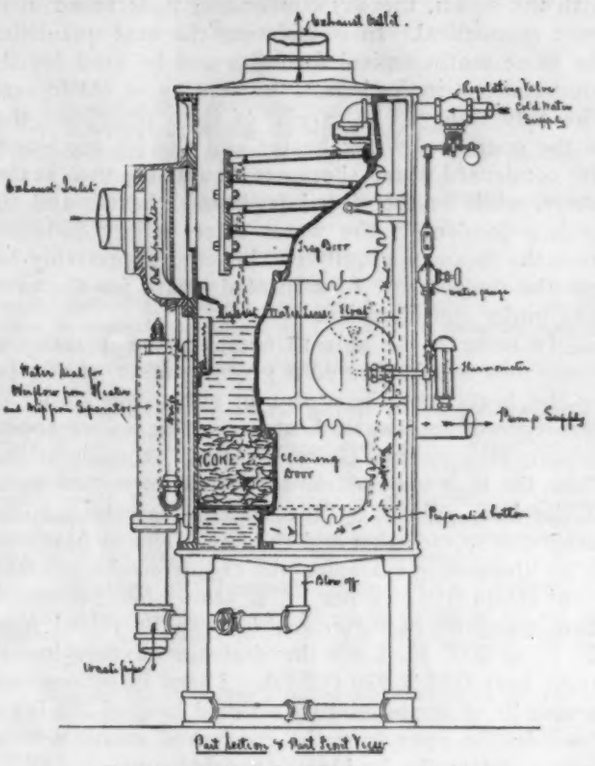


Fig. 18. Cochrane Feed-water Heater.

The Wainwright even-flow surface condenser as shown in Fig. 19 is a good illustration of surface condensers and also illustrate the closed type of feed-water heater. The steam is exhausted into the main drum as shown, and water circulates through copper tubes traversing this drum. These tubes are held in the tube plates without any soft packing or screw glands, but by the use of hard brass thimbles tightly driven. The grouping of the tubes sends the circulating water at least four times through the condenser chamber.

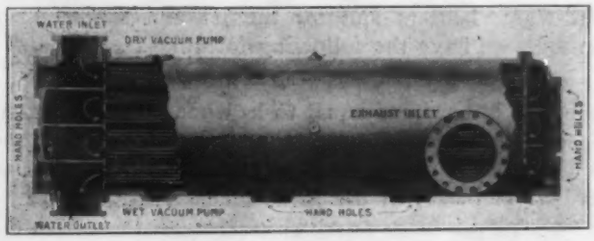


Fig. 19. Wainwright Surface Condenser.

It is evident, then, that the feed-water heater serves a double purpose; for, if properly installed, the water going into the boiler is not only heated, but by condenisng the exhaust steam it increases the mean effective pressure of the steam in the engine cylinder. Operating under these conditions our engine is said to be condensing. Pressures below that of the atmosphere are thereby used.

In ocean-going vessels the so-called surface condenser is used almost entirely, for the salt water pumped in from without must not be allowed to go directly into the boilers as it is very detrimental. On the other hand, for stationary engines on land, the jet condenser in which the cool water mingles directly

with the steam, thereby condensing it, is found often most economical. In considering the heat quantities, the same mathematical formulas can be used for the computations in feed-water heaters as in condensers. The only thing to be careful of is to remember that in the open feed-water heater and the jet condenser, the condensed steam becomes equal to the heated water, while in the closed feed-water heater and the surface condenser, the water after being condensed from the steam is usually not lowered appreciably below the temperature of saturated steam for the pressure under consideration.

In order to be able to compute the quantity of water that will be heated a given number of degrees by the heat from the steam in either the closed or open type of feed-water heater, once again we appeal to our elementary Thermodynamic considerations. Thus, the heat surrendered by the steam will be equal to the heat gained by the water, neglecting minor losses due to radiation and the like. This is best seen by an illustrative example. An engine discharges 8000 lb. of steam 0.95 dry per hr. at atmospheric pressure. How many lb. of water per hr. can be raised from 60° F. to 200° F.. Each lb. of steam mixture has as latent heat 0.95×970.4 B.t.u. There is represented in each lb. of steam mixture a liquid heat of 180 B.t.u. also. In the open type the condensed steam will be come equal to the feed-water temperature, or 200° F.

Hence in 8000 lb. we have, letting x be the number of lb. of water heated

$$(0.95 \times 970.4 + 180)\ 8000 = x\ (200 - 60) - 168$$

$$7{,}468{,}000 = 140\,x$$

$$\therefore x = 53{,}300 \text{ lb.}$$

In the case of the closed type, the water from the condensed steam does not cool below 212° F. Hence we have

$$(0.95 \times 970.4 + 180 - 180)\ 800 = x\ (200 - 60)$$

$$7{,}372{,}000 = 140\,x$$

$$\therefore x = 52{,}650 \text{ lb.}$$

Generally speaking, then, for the open and closed feed-water heaters and for the jet and surface condensers, we have the following formulas:

$$W\ (x_e\ L_e + h_e - h_2) = w\ (h_1 - h)$$

in which h_2 becomes equal to h_e when considering the closed feed-water heater or the surface condenser, and h_2 becomes equal to h_1 when considering the open feed-water heater or the jet condenser, where

W = lb. per hr. of steam condensed,
w = lb. per hr. of water heated,
x_e = quality of steam at exhaust pressure,
L_e = latent heat at pressure of exhaust.
h_e = heat of liquid in exhaust steam,
h_2 = heat of liquid at final cooled temperature of condensed water.
h = heat of liquid in feed-water before heating,
h_1 = heat of liquid in feed-water after heating.

It is a matter of common knowledge that the pressure of water from the water mains usually installed is not sufficient to force water into a steam boiler operating under the usual conditions of installation. Hence, some device must be used that can force the water in against the boiler pressure. This is accomplished in a great many plants by means of a force pump. Under many conditions of operation especially on locomotives, a socalled injector is found most useful for this purpose.

The Penberthy automatic injector is a well-known make of this class of apparatus. Fig. 20 shows a sectional view as well as the outside appearance of this

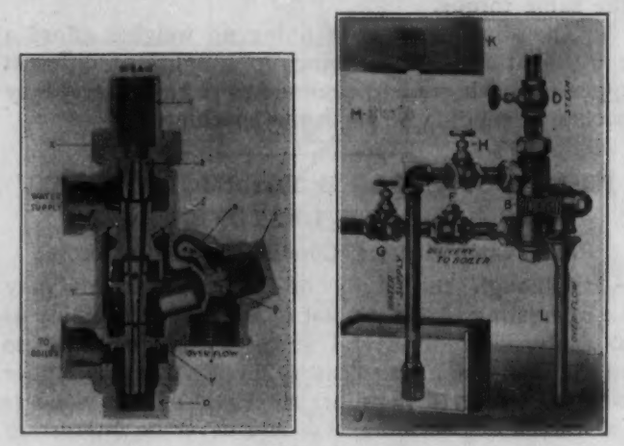


Fig. 20. Cross Section View of Penberthy Injector and View of Injector Installed.

injector, installed for operation. In this class of apparatus the steam is allowed to attain a high velocity, and, on being condensed by coming in contact with a stream of cold water, gives up part of its kinetic energy, so that the mixture enters the boiler against the pressure of the boiler. The steam to operate the injector is taken from the boiler and enters the injector at the point marked "steam" on the cross-sectional diagram, and at R begins to expand. In expanding, the steam gives up part of its heat energy, which is at once converted into kinetic energy. As the swiftly moving steam passes the opening indicated by the direction of the arrow at "water supply," a vacuum is formed and cool feed-water is drawn with the steam through S. The water almost instantly condenses the steam, and the impact of the steam greatly increases the velocity of the water. It is a well-known hydraulic principle that when water is flowing in a pipe with a given velocity, and under a given pressure, a decrease of velocity is accompanied by such an increase of pressure that the sum of the kinetic and potential energies of the water remain constant. In starting the injector, until sufficient pressure is generated to open the check valve into the boiler, the water is sent through the side opening "overflow" on the diagram. It is seen that as the water and steam mixture traverse Y, the opening gets larger and larger, which means that the velocity gets smaller and smaller. Since kinetic energy is mathematically expressed as the product of one-half the mass of a moving body by the square of its velocity, it is evident that this decreasing of the kinetic energy immediately shows itself in form of pressure or potential energy, since we know that energy, itself, is indestructible. Hence, when sufficient pressure is produced, the counter pressure of the boiler is overcome, and water allowed to enter.

Let us act upon the mechanical principles above enunciated and derive simple mathematical expressions governing the injector. Let x_e, L_e, h_e be the state of

the steam after our usual terminology; h is the heat of the entering water and v its velocity; h_1 is the heat of the discharged water, and V its velocity; y is the pounds of water drawn into the boiler per lb. of steam used by the injector. Since the total heat of the steam is as formerly derived, $x_0 L_0 + h_0$ per lb., and the heat possessed by the entering water y h, as y lb. are used per lb. of steam, the total heat energy is $x_0 L_0 + h_0 + y h$, and to this must be added the kinetic energy of the water, which is $\frac{v^2}{2g} \times \frac{1}{778}$. Hence we have the relationship

$$x_0 L_0 + h_0 + y \left(h + \frac{v^2}{2g}\right)^{1/778} = (1 + y) \left(h_1 + \frac{V^2}{2g}\right)^{1/778}$$

The right hand side of the equation above easily follows, since energy is never destroyed and since each lb. of steam now has y lb. of water, the combined mixture represents (1 + y) lb. The quantity representing the square of the velocity appearing on both sides of this equation is very small compared with the other items. Hence it may for all practical purposes be entirely neglected. We then have as our equation for the injector,

$$x_0 L_0 + h_0 + y\, h = h_1 + h_1 y$$
$$y\,(h_1 - h) = x_0 L_0 + h_0 - h_1$$
$$\text{or } y = \frac{x_0 L_0 + h_0 - h_1}{h_1 - h}$$

If s is the head against which the water is forced in order to get the water into the boiler, we have for the energy absorbed (since work is the product of force and distance) a quantity equal to s (1 + y) ft. lb. But $x_0 L_0 + h_0 - h$ is the energy in the entering steam and water, hence the efficiency of the injector is

$$\frac{s\,(1 + y)}{x_0 L_0 + h_0 - h}$$

In the study of mechanics we learn that the product of mass and velocity is called momentum, and that when impact takes place between two elastic bodies the sum of momentum in both bodies before and after the shock is the same. Hence the momentum of the 1 lb. of steam issuing from the nozzle added to the momentum of the y lb. of water drawn in must be equal to the momentum of the (1 + y) lb. of the mixture after the impact. Therefore

Where v_1 is the velocity of the entering steam,

$$v_1 + y\, v = (1 + y)\, V$$

From this relation we are enabled to compute velocity relationships when certain quantities are given in injector design. The student will do well to examine the Thermotwisters given in this lecture and see if application of these formulas above given can easily be made.

The question of design or choice of condensing surface is usually solved by Whitham's empirical formula.

$$S = \frac{W L_0}{180\ (t_0 - t)}$$

Where

S = square feet of condensing surface,

W = weight of steam condensed per hour,

L_0 = latent heat at the temperature of exhaust steam.

t_0 = temperature of exhaust steam,

t = average temperature of circulating water between inlet and outlet.

Thermotwisters.

1. Water is to be raised from 60° F. to 200° F. in a feed-water heater, the weight of water being 10,000 lb. per hour. Heat is supplied by steam at atmospheric pressure, 0.95 dry. Find the weight of steam condensed (a) in an open heater, (b) in a closed heater. Find the surface necessary in the latter.

2. Steam 0.96 dry at 130 pounds gauge pressure delivers 3250 pounds of water per hour from an injector at a temperature of 165° F., the inlet temperature of the water being 62° F. The water is measured on the inlet side of the injector. Find the weight of steam used. The velocity of the entering water is 13 ft. per second. That of the discharge is 115 ft. per sec. Find the velocity of the steam leaving the discharge nozzle. How many boiler horsepower are required or represented in the steam necessary for the injector?

Solution of Thermotwisters—Fifth Lecture.

1. Find the volume of one pound of air in an air compressor at a pressure of 100 lb. per sq. in., the temperature being 32° F., using Boyle's law only.

$$p\,v = p_0 v_0$$

Now at 32° F., v_0 for 1 lb. of air is 12.39 cu. ft. and p_0 = 14.7 lb. per sq. in. or 14.7 × 144 lb. per sq. ft. Hence substituting

$$v = \frac{p_0 v_0}{p} = \frac{14.7 \times 144 \times 12.39}{100 \times 144} = 1.82 \text{ cu. ft.} \quad \text{Ans.}$$

2. From Charles' law, find the volume of one pound of air at atmospheric pressure and 72° F.

$$v = v_0 (1 + t/273)$$

72° F. = 22.22° C. and v_0 = 12.39 cu. ft.

Hence substituting,

$$v = 12.39 \left(1 + \frac{22.22}{273}\right) = 13.4 \text{ cu. ft.} \quad \text{Ans.}$$

3. Find the temperature of 2 ounces of hydrogen contained in a 1-gallon flask and exerting a pressure of 10,000 lb. per sq. in.

$p\,v = R\,T$ $\quad p = 10{,}000 \times 144$ $\quad R$ for hydrogen = 770

2 ounces = 1 gallon.

16 ounces or 1 lb. = 8 gallons = 1.068 cu. ft.

$$\therefore T = \frac{p\,v}{R} = \frac{10{,}000 \times 144 \times 1.068}{770} = 2000.0° \text{ F. abs.}$$

or 2000 − 459.4 = 1540.6° F. Ans.

4. How large a flask will contain 1 lb. of nitrogen at 3200 lb. pressure per sq. in. and 70° F?

$p = 3200 \times 144$ $\quad T = 459.4 + 70 = 529.4$

$p\,v = R\,T$ $\quad R$ for nitrogen = 54.9

$$\therefore v = \frac{R\,T}{p} = \frac{54.9 \times 529.4}{3200 \times 144} = .0631 \text{ cu. ft.} \quad \text{Ans.}$$

HYDRO-ELECTRIC ENTERPRISES IN BRAZIL.

By decree No. 8753 the Brazilian Federal Government gives a concession to engineers Francisco de Paula Ramos and Hans Hacker, representatives of commercial firms of Rio de Janeiro—Valle Rodrigues & Ramos, and Bromberg, Hacker & Co.—or to such enterprise as they shall organize for the exploitation of the hydraulic power of the Paulo Affonso Falls of the River San Francisco. The contract is for 70 years maximum, and requires a first installation of 200,000 horsepower, increased up to 1,000,000 kilowatts in 15 years after the inauguration of the first hydroelectric installation. The Sao Paulo Light & Power Company has acquired the great falls of Firambella, between Santos and Mogydas Cruzes.

WATER RIGHTS IN NORTHWEST.

BY NORWOOD W. BROCKETT.

This is probably the broadest question with which the Hydroelectric Company must deal. In the State of Oregon the matter rests with a commission operating under a water code and is principally a matter of following the statute. Broadly speaking, the riparian owner has the right to divert the water at any point upon his property for the purposes of generating electric light and power, provided he returns the water to its natural channel within the boundaries of his own land. If he does not own all the riparian rights between the point of diversion and the point of return, it is necessary that he acquire such rights, either by purchase or condemnation, from the riparian owners, as each such owner has a legal right to have the water flow by his land in the manner in which nature intended. In the absence of any appropriation or development, however, the measure of such owners' damage is limited to the financial loss which he sustains for domestic and agricultural uses and if sufficient water is left in the stream to meet such uses, his damage would be merely nominal. If an appropriation of water has been made prior to such diversion then such lower riparian owner must not only show that he intends to devote the water to a public use and the necessity therefor, but must also show that he has followed usch appropriation with reasonable diligence, preparatory to the actual use of such water.

This brings us to the consideration of the effect of notices of appropriation of water, upon which there is apparently considerable difference of opinion. In Washington and Idaho the Pacific Coast Doctrine that "the first in time shall be the first in right" controls. This does not mean that the mere posting and filing of a notice of appropriation will "hold down" a stream for an indefinite length of time, but that it must be followed with reasonable diligence in perfecting the use of the water; nor does such a notice give to the appropriator the right to divert the water from a lower riparian owner without compensating him as heretofore explained. It is, however, a notice to the world that the appropriator intends to devote so many cubic second feet of a stream's flow to a public use and all subsequent appropriators must take notice of this declaration; provided the appropriation is followed with reasonable diligence. It gives such an appropriator the right to the use of this water and prevents it from being diverted so that a diminished volume would flow through his property. As before stated, this right exists without such appropriation, but by stamping it with a public use, followed by reasonable diligence, it prevents an upper riparian owner from condemning the water from such appropriator upon the theory that one public service corporation cannot condemn property for is own use, which has already been devoted to a public use.

The right to overflow the land of another without his consent depends, of course, entirely upon the right of eminent domain. The right to overflow state land has, however, been clearly given in the State of Washington and we desire to urge upon those companies requiring storage facilities upon State lands, the necessity of perfecting such rights while this law is in operation. The statute is mandatory: it compels the State Board of Land Commissioners to grant such rights upon application and upon a showing that the land is to be used for the storage of waters for a public use. It is not necessary to purchase the property, but the damages to the State by reason of the overflow are fixed and paid and the right becomes perpetual. The question was recently raised by the State Board of Land Commissioners as to the right of a public service corporation, in damming a river, to store the waters so that they covered the banks between low water and ordinary high water, upon the theory that the State owned the banks of navigable lakes and streams up to high water mark. This contention is probably correct in so far as it affects navigable rivers. The Commission held that any river which would float a shingle bolt was a navigable river, within the meaning of the constitution. In this, however, the Commission is unquestionably wrong, as the Supreme Court has repeatedly decided that this section of the constitution means those rivers navigable for the ordinary uses of commerce and trade.

In storing water, however, by means of a dam, where the raise in the banks of the stream does not exceed or even reach the mark of ordinary high water, the riparian owner may claim damages. Such a question recently arose in the writer's company, where the rise and fall was approximately three feet a day on the claimant's property, caused by the storage of water from the company's dam. At no time was the water raised to a height which even approximated the high waters of the river, but the waters were raised to a point three feet above the mean low water in the summer. Investigation convinced the writer that the upper riparian owner was entitled to have the water flow by his property at the natural rate of flow and that any change in such flow entitled the owner to recover such damages as he had sustained. The claim for damages in this case was based upon the caving of his banks and the sub-irrigation, which caused a portion of his property lying contigous to the river to remain moist at all seasons of the year.

METHODS OF ACCOUNTING IN CONNECTION WITH NATIONAL AND STATE LEGISLATION.

BY C. N. HUGGINS.[1]

It is regretable for some reasons that external regulation of corporations engaged in supplying public service is not vested exclusively in a National Commission operating much in the same manner as the Interstate Commerce Commission, instead of such control being divided among several National, State and Municipal Commissions or Boards, each requiring some information not exacted by the others and each wishing the same results shown in a somewhat different way. Until we have some such plan of exclusive commission regulation I am afraid no general or uniform system of accounting will be found entirely adequate or satisfactory for use in different States. In the case of the Portland Railway, Light & Power Company, it must now report to the Interstate Commerce Commission, to the State Railroad Commission, to the State Tax Commission, to the City of Portland, and, of course, to the Internal Revenue Department.

[1]Treasurer Portland Railway, Light and Power Company.

Last winter a State Public Service Commission was created by the Legislature, but a referendum petition has been filed against his measure, which will not come before the people until November, 1912. In Washington the State Commission is already in legal existence, and I believe they also have a State Tax Commission, while a multiplicity of commissions exists in almost all other States.

Those of us who come under the regulation of the Interstate Commerce Commission are probably more local bodies, and our systems of accounting have because of a longer acquaintance, than with those of the local bodies, an dour systems of accounting have become pretty well standardized in the Railway Department. Likewise in the Light and Power Departments we have yielded more and more to the uniformity ecommendations of the National Association, until among the larger companies and many of the smaller ones fairly uniform methods of accounting are in vogue, although classifications of accounts seem to be somewhat at variance. This will always be the case so long as we are called upon to furnish information in more or less conflicting form. However, if we all use the methods standardized by the American Street and Interurban Railway Association and the National Electric Light Association and will subdivide our primary classifications liberally, we will find ourselves able without serious difficulty to furnish reports in almost any form demanded.

There has always been a hesitancy on the part of Public Service Companies to properly inventory and classify their property accounts, but I feel that we must now recognize the fact that we will be required to furnish sooner or later an accurate property inventory, and, if we have not already done so, we should at once take steps to prepare a very careful and fully detailed statement of all property. Such an inventory must be consistently made and records must be in such shape as to permit of ready verification.

In Oregon we are required to make report to the State Tax Commission of all property segregated among the various school, road and other taxing districts, and are supposed to show the average daily quantity of eleectricity furnished to public and private consumers in each of said districts. This is a rather difficult thing to do, and recognizing this fact, the commission has thus far waived the demand for quantities of electricity furnished. I hope they may continue to do so, but we should be prepared to furnish, at least, all reasonable information.

There has been a great change in the attitude of corporations toward public commissions during the last two or three years, and we are now appreciative of the fact that while there may be considerable annoyance in complying with the numerous demands made upon us and considerable extra expense entailed in doing so, still we have received much direct benefit from their oversight and are reaching a higher plane of stability. This is not due to any remedial action brought about from fear of investigation, but the results are obtained from several causes.

The most beneficial effort of Commission oversight has undoubtedly been due to opportunities, somewhat forcibly thrust upon us, of observing the weak points in our business methods and providing remedies therefor. Furthermore, the supervision of Governmental Commission undoubtedly acts as a stamp of approval on the reporting companies, just as much as the inspection of National Banks, the green label on the bottle of bonded whiskey or the purple stamp of the Government Meat Inspector, and the time is rapidly approaching when investors will be very chary indeed of securities of public utility companies which are not under commission regulation. This feeling is already existent and is rapidly growing.

The State Commissions will not be found unreasonable and will unquestionably co-operate with the corporations reporting to them in adopting such reasonable forms as will most readily furnish information desired with the fewest possible complications.

I understand that several of our members in the State of Washington are now working out a revised system of accounting to be submitted to the State Commission for discussion, and I think if this Association can be of any assistance in this work through a committee or otherwise, such assistance should be tendered. Furthermore, I would recommend that when such revised system is finally adopted this Association should provide itself with full information thereon, and through its Executive Committee or otherwise should endeavor to secure the adoption of the same system in Oregon and other of our Western States where Commissions are not yet in existence.

I do not wish it understood that I am in favor of absolutely uniform classification for all operating companies, as from the different local conditions affecting almost all of our member companies it is, in my opinion, entirely impossible to observe such uniformity of classifications with satisfaction to the officers and owners of the properties.

From time to time the Light and Power Associations have tried to delude themselves with the idea that perfect unifomity was essential, but I think we must all agree that such is not the case. This does not change my recommendation that the system of accounting shall be uniform, and that the methods followed in obtaining results shall be along the same general line.

In the case of my own company, some of our interests require certain information which is not demanded by any Commission, but which is of vast importance to the officers of the company. Under the liberal methods of dividing classifications, we are able to furnish this information for our own people without in any way impairing our ability to supply data to Commissions, but I can suggest no reason why any other company should subdivide to the same extent, as it is quite possible that in few other cases would such additional information be desired by anybody.

NORTHWEST LIGHT & POWER ASSOCIATION

The Northwest Light & Power Association which recently convened at Spokane conducted during the past year some interesting investigations into problems pertaining to electrical development in the Northwest. The two preceding papers by Norwood W. Brockett and C. N. Huggins are abstracts from papers delivered at the recent convention.

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CONTENTS

Power Possibilities in the Inland Empire..... 365
By Harrison Williams

For Oil-burning Locomotives, Sacramento Division, Southern Pacific Co..... 368
San Francisco Branch of A. I. E. E..... 368
Public Service Commissions..... 369
By Max Thelan

Iron Loss in the Current Transformer..... 373
Relation Between Weight and Output of Industrial Motors.. 374
Primer of Applied Thermodynamics..... 375
Hydro-Electric Enterprises in Brazil..... 377
Water Rights in Northwest..... 378
By Norwood W. Brockett

Methods of Accounting in Connection With National and State Legislation..... 378
By C. N. Huggins

Northwest Light & Power Association..... 379
Editorial..... 380
Inland Empire.
Montana Water Rights.
Ground-Breaking World's Fair.
Personal..... 382
Electrical Contractors' Notes..... 382
Obituary..... 383
Trade Notes..... 383
Meeting Notices..... 383
Book Review..... 383
Industrial..... 384
Protective Results Accomplished by Arcing Rings on Transmission Lines.
H. W. Johns-Manville Company's Exhibit.
New Long-Life Flame Arc Lamps.
News Notes..... 386

Inland Empire

The leading article in the Journal of this issue deals in the electrical possibilities of the Inland Empire. The engineer engaged in hydroelectric development in the West is peculiarly fortunate in that he gets from his labors that inward satisfaction arising not only from the practice of his profession in the abstract, but the communion with nature he enjoys while gathering data in the mountains of the West, inspires him with the highest ideals. The world has long since known of the wonders of the Yosemite and the high-pressure power plants of the State of California. The rapid development, however, of the so-called Inland Empire, comprising the Columbia River drainage tributary to Spokane, has been brought about so quickly one can scarcely realize that a transformation from desert and undeveloped lands to high class orchard and farm tracts is each day nearing its completion.

As the great waves sweep inward to the shore, break upon its banks and there again drift outward, the tide of population first swept across the American continent, broke at the shores of the Pacific, and now is sweeping backward to the mountains, filling every available nook and inlet, thereby transforming them into fruitful productive valleys. So great has this impetus for increase of population been, it is found that Spokane, the distributing point of the Inland Empire, has become the center of a network of interurban electric lines third in size to any city in America.

This sudden gowth has led engineers and others interested in the industrial opportunities of the West, to investigate the future power possibilities of this resourceful country. The fruits of the investigation have proved of interest both to those of the aesthetic turn of mind and to the mind bent solely on affairs practical. In considering the aesthetic side of this great drainage district of our Western Empire, one is almost overcome with its beauties. When gazing upon the graceful bodies of water found in the Inland Empire leaping in their playful, joyous rush to the ocean, forming water falls of exquiste beauty crowned with mists of rainbow dew, one can almost imagine the frightened but graceful Arethusa of old, arising with honeyed lips from the waters, and in moments of playful fantasy, one can see her as she appeared to Shelley, when he wrote:

"And gliding and springing
She went, ever singing
In murmurs as soft as sleep;
The earth seemed to love her,
And Heaven smiled above her
As she lingered towards the deep."

But the all-fired practical man arouses the dreamer from his dreams, brings him back to earth, and behold he sees in this beautiful sight a poetry more delicate than words—a poetry to be sung by the "earth bound" in their relief from the burdens the latent water powers of the Columbia will bring. Hand in hand the development of all parts of the West must go. An empire to attract the attention of the world must be as varied and as diversified in interests and opportuni-

ties as old mother earth herself. The West is proud of its Inland Empire, and the continuance in its remarkable growth means another forged link in the fight for world-wide commercial supremacy.

Montana Water Rights

Elsewhere in these columns will be found an article dealing with the question of water rights in the State of Washington and slightly touching on usages in the States of Idaho and Oregon. The question of water rights has always been in the West one of the most vexing. The strife and confiict in California during the early days and, in fact, even down to the present has been a horrible example of lost time and energy, which could have been obviated by more clearly defined laws properly enforced.

Wyoming is today perhaps the most advanced State in the Union as regards the just and equitable operation of water right appropriations. When one travels through this thinly settled State in a study of the water usages there in vogue, one is struck very forcibly with the foresight used in planning the entire scheme of water districts and water commissioners. Much credit is due Elwood Mead, the noted irrigation expert, and a former State Engineer of Wyoming, for the model operation here seen.

The great State of Montana, immediately to the north, presents to the world a pitiful spectacle with its confusing system of appropriations and county jurisdictions. Most of the Western States have found the control of water appropriations by the State Engineer's office a most efficient scheme, as all water appropriations are thereby unified. In Montana, however, no such centralized scheme exists. An appropriator simply posts his notice and files the same in the local county clerk and recorder's office. At a subsequent date the district court, when properly petitioned, may adjudicate the waters of the stream. The consequence of this system is that in some parts of the State one inch of water to the acre is allowed by the courts for irrigation purposes, while in the neighboring district an entirely different basis is in vogue. The result is a diversity of rulings and complexity of status in water rights appreciated only by the hungry-eyed attorney, specially grafting on water right cases, but wholly unappreciated by the owner of the water rights, who desires stability of ownership and a reasonable disbursement for an equitable adjudication.

Such a primeval system was well-suited to the pioneer days of Montana, for water was so plentiful and inhabitants so few, clashes on water rights were infrequent. Today, however, Montana presents to the world the greatest possibilities in arid land reclamation of any State in the Union. Her water powers, now dormant, will soon demand the attention of the commercial world. It behooves Montana enterprise to awake to the critical situation of water right appropriations, and to place this most valuable asset in the great Treasure State on a more orderly and systematic status, so that their validity may be unquestioned.

Ground-Breaking World's Fair

The past week has put a happy countenance on the face of every true Westerner. The contagious smile of President William Howard Taft is mirrored in the expression of thousands. The words of the President at the ground-breaking exercises for the Panama-Pacific International Exposition are so sincere, so timely, and so kindly, that echoes of optimism and renewed hope and vigor are heard from the high crest of the Rockies on the East to the loud-roaring Pacific on the West. Those who live in our western empire have long since felt its charms and have become imbued with its boundless possibilities.

But to have our President come to the Coast, breathe our invigorating atmosphere, inspect our progress, and then tell us the good things he sees in store for us after the completion of the great Panama Canal, is almost enchanting.

The beginning of the upbuilding of the great exposition project, so auspiciously started by the President at the ground-breaking exercises during the past week, is now followed by an announcement of intense interest to those following the trend of affairs electrical at the great Panama-Pacific Exposition. Word has come from Gano Dunn, president of the American Institute of Electrical Engineers, announcing the enthusiastic reception accorded by the International Electrical Congress at Turin to the invitation issued by him in the name of the American Institute of Electrical Engineers to meet at San Francisco in 1915. Such technical gatherings in the past have indelibly left their impression on the technical world as mile-stones of accomplishment in the electrical art. The very getting together has spurred scientists and inventors to greater endeavor; and higher thought, keener intellect, broader human advancement have been the result.

Great investigators, in the study of sociological development, have found that the question of environment not only molds the future characteristics of the child, but in fact, shapes and sways the very destiny of human progress and advancement.

If this be the case, what of environment at the next International Electric Congress to be held in 1915?

The site as chosen by the Fair committee commands a sweeping background of the country eastward even beyond the Sierras to the distant Rockies; immediately in the background is seen the rebuilt San Francisco; while in front are the Golden Gate and the Pacific. Backed up by the boundless possibilities presented in hydroelectric development in the Sierras and Rockies; with the inspiration gathered from an immediate view of a city burned to earth, but arisen in greater splendor by the unparalleled efforts of a brave, fearless people; the gorgeous view to the west, stretching out of the Golden Gate to the entire world, should present such a dazzling picture of promise that the fruits of this gathering will unquestionably be thought and invention hitherto unknown.

PERSONALS.

Carl Holley, an electrical engineer of Visalia, is at San Francisco.

J. S. Johnson, president of the Visalia Water Works Company, of Visalia, is at San Francisco.

R. Q. Cleavenger, representative of the Phoenix Glass Company of Pittsburg, is at Los Angeles.

J. H. Newlin, purchasing agent of the San Joaquin Light and Power Corporation, is in the city.

H. E. Sanderson, Pacific Coast manager for the Bryant Electric Company, is again visiting Los Angeles.

R. B. Cartwright of Alhambra, who is connected with the Pacific Electric Company, is at San Francisco.

B. C. Ball, chief engineer of the Willamette Iron Works, of Portland, was a recent arrival at San Francisco.

H. M. Bishop, general manager of the South Sacramento Power Company, is a recent arrival at San Francisco from Sacramento.

A. G. Wishon, general manager of the San Joaquin Light and Power Corporation, of Fresno, was a recent arrival at San Francisco.

Guy W. Talbot, George F. Nevins, A. S. Greuner and George L. Meyers, prominent electrical men of Portland, were in Seattle recently.

Wallace W. Briggs, assistant sales manager of the Westinghouse Electric and Manufacturing Company, is at East Pittsburg on business.

W. R. Dunbar, a salesman in the Westinghouse detail and supply department, is also visiting the company's factory at East Pittsburg.

H. A. Russell, local sales agent of the General Electric Company, with headquarters at San Francisco, is spending a month in New York.

John S. Baker, Pacific Coast district manager for the Crocker-Wheeler Company, of Ampere, N. J., is at Los Angeles on electrical business.

A. B. Saurman, manager of the Pacific Coast department of the Standard Underground Cable Company, is making a tour of the Pacific Northwest.

W. P. Hammon, the head of the California-Nevada Power Company, is again at his San Francisco office after spending two months in the East on business.

J. E. Poindexter, a district manager of the Pacific Gas and Electric Company, with headquarters at Marysville, is among the recent arrivals at San Francisco.

W. E. Chase, of Plummer, Idaho, who has a large contract for electrical equipment at a Puget Sound fort, was in Seattle recently on his way to the contract to supervise the work.

R. G. Hanford, one of the vice-presidents of the United Properties Company, is at New York on an important financial mission connected with the extension of the corporation's activities.

W. L. Huber, district engineer, who has jurisdiction over water powers in District No. 5, United States Forest Service, is at San Francisco after spending some time on the forest reserves.

J. A. Vendergrift has just returned to Oakland from Los Angeles, where he has been in consultation with S. E. Doane, chief engineer of the National Electric Lamp Company of Cleveland, Ohio.

Ex-United States Senator Eli Whitney, who is at the head of the principal electric power company supplying New Haven, Conn., with current, is at San Francisco on a tour of the Pacific Coast.

H. C. Goldrick, Pacific Coast manager of the Kellogg Switchboard and Supply Company, of Chicago, left for Portland last Tuesday and will close up some pending business in his line in the Northwest.

J. D. Holmes, general manager of the Home Telephone and Telegraph Company, is at San Francisco investigating the latest pole line practice under the new city regulations, with a view to adopting the improvements observed.

A. L. Jaqueth, engineer, has assembled a crew of several assistants at Kalispell, Montana, and has inaugurated work on the survey for the Flathead interurban electric line. Sites are being secured for car shops and other traction facilities.

J. H. Wise, assistant general manager of the Pacific Gas and Electric Company, is visiting Lake Fordyce with H. C. Vensano, the company's civil engineer, in connection with the tunneling and other hydro-electric work in progress on the South Yuba system.

Leon M. Hall, electrical engineer, has returned to his San Francisco office from Coalinga after doing some preliminary work on a dam which is to be constructed for irrigating the Avenal Ranch of Balfour, Guthrie & Co., and other properties in that district.

R. F. Chevalier, testing expert, of San Francisco, and E. S. Ferrier, assistant electrical engineer of the Southern Pacific Company, are receiving the heartfelt thanks of the sophomore engineering students of the University of California for the able and interesting manner in which they recently conducted the students through the Fruitvale plant of the Southern Pacific.

Gano Dunn has just returned from abroad, where, as a representative of the United States Government, and as president of the American Institute of Electrical Engineers, he has been attending the International Electrical Congress at Turin and the meeting of the International Electro-Technical Commission, the body that has been organized to bring about international uniformity of standards and practice in the electrical industry. Mr. Dunn, who for many years was first vice-president and chief engineer of the Crocker-Wheeler Company, and is a past president of the New York Electrical Society, has been elected a director and a vice-president of J. G. White & Company, Inc.

ELECTRICAL CONTRACTORS' NOTES.

H. W. Jacobs, an electrical contractor of Santa Rosa, is at San Francisco.

Ivan Berry, who is in the electrical business at Los Angeles, is a San Francisco visitor.

D. W. Thomas, an electrical contractor of Petaluma, was visiting the San Francisco supply houses during the past week.

Apropos of building up loads for central stations, R. D. Holabird of the Holabird-Reynolds Company, states that a certain power company decided to exploit the sale of electric flat irons and other electric appliances among the consumers on its circuits. This decision was reached about two years ago. During this comparatively brief interval the income from current consumption necessary to operate the appliances that have been sold has increased until it is now sufficient to pay the interest on $1,250,000 of the power company's bond issue. All this was accomplished practically without the addition of a single new transformer, or meter, and 85 per cent of the current consumed by these appliances is "off-peak" load.

OBITUARY.

Otis Carter Post, of the switchboard sales department of the Westinghouse Electric & Manufacturing Company, died suddenly of cerebral embolysm at his residence in Wilkinsburg, Wednesday night, September 13. His death will be sad news to the host of friends he has made.

Everett Copley of the New York sales office of the Westinghouse Electric & Manufacturing Company, died at his home in New York on Thursday, September 27, of typhoid fever. About three years ago he entered the New York sales office of the Westinghouse Company, where his great capability and thorough knowledge of electrical work soon gained for him the admiration of his fellow employes and a bright future was the prediction of everyone associated with him.

TRADE NOTES.

Thomas Mirk, of Hunt, Mirk & Co., is at San Diego to start work on a new contract. It includes installing for the San Diego Electric Railway Company an underground steam heating system. The waste steam from the railway power plant will be utilized. The system of mains adopted is that of the American District Steam Heating Company of Lockport, N. Y.

The General Electric Company has sold to the Centralia Light and Traction Company of Centralia, Wash., one A.T.B. 2, 500 kw., 8 p.f., 625 k.v.a., 3600 r.p.m., 2300 v., horizontal Curtis turbine generating set arranged for 200 lbs. steam pressure, and 2 inches absolute back pressure. Accompanying the above is one C.C. 2, 7 kw., 5000 r.p.m., 120 v.-125 v., non-condensing Curtis turbine exciter set.

J. H. Hansen, hydraulic engineer, with the Pelton Water Wheel Company, has returned to the San Francisco manufacturing plant after spending some time in Southern California in consultation with officials of the Pacific Light and Power Company. The Pelton Company is remodelling the Borel power station near Caliente. Three 3000 kw. generating units are to have their present wheels replaced with three Pelton-Francis turbines. These massive machines, having cases weighing 14 tons each, are being constructed at San Francisco.

The Globe Grain and Milling Company, after a year's trial of electrical operation of their flour mill at Los Angeles with Westinghouse induction motors aggregating 400 h.p., are so satisfied with the resulting economy that they have decided to electrize their San Francisco plant throughout. Standard Westinghouse C. C. L. motors, aggregating 700 h.p. have been ordered. The main drive will consist of two 250 h.p. induction motors. This will be the largest electrified flour mill on the Coast, and probably it ranks next to the big flour mills at Minneapolis.

The Farnsworth Electrical Works of San Francisco report the sale of a complete generating plant and transmission line equipment to the Gray Eagle Gold Mining Company, in Sierra County, Cal. This includes the installation of a 125 kw. second-hand G. E. three-phase, 2300 volt generator with necessary switchboard equipment, together with three 15 kw. three 10 kw., three 3 kw. and one 6 kw. transformer, one 30 h.p., two 20 h.p. and one 10 h.p. motors, as well as material for 1½ miles of transmission line. The generator will be driven by a Samson low pressure turbine. The Farnsworth company has also built a 75 kw. 6600 volt transformer to the order of the Alta Bert Gold Dredging Company in Trinity County, California.

The H. W. Johns-Manville Company, 100 William street, New York, is putting on the market a waterproofing fabric which is a strong, loosely woven burlap impregnated with pure asphalt. It is advanced for this that it not only clings but becomes locked into the fabric. It is claimed that a few layers of it makes a waterproof course of great strength, ductility, and so forth, also that it remains intact and resists moisture even when cracks occur in the cement work. The company is putting on the market a waterproofing asbestos felt, which being composed only of mineral substance is stated to be especially adapted for waterproofing all exposed and foundation construction work. A waterproof coating is also being offered which is a combination of carefully selected materials. It is claimed when this is applied that moisture can not penetrate it. The Seattle office of the company is at 1020 First avenue South.

MEETING NOTICES.

The sixth congress of the International Association for Testing Materials, will be held at the Engineering Societies Building, New York City during the week beginning September 2, 1912. The society has the highest aims possible in advancing an important adjunct to engineering progress and merits the support of all engineers.

The San Francisco Branch of the American Institute of Electrical Engineers will meet at the Home Telephone Company's Building at 8 p. m., October 27th. C. F. Elwell will present a paper on High Tension Direct Current Transmission. The discussion will cover the Thury system in vogue in European installations.

The San Francisco members of the American Society of Mechanical Engineers attended a banquet at the Fairmont Hotel on the evening of October 17 in honor of E. D. Meier, the national president. The matter of holding a national meeting at San Francisco at the time of the Panama Pacific Exposition was thoroughly discussed and will receive the enthusiastic support of President Meier.

BOOK REVIEW.

Cyclopedia of Telephony and Telegraphy. Prepared by a corps of telephone and telegraph experts, and electrical engineers of the highest professional standing; size 6½x9½ inches; 1572 pages, bound in four volumes; illustrated with over 2000 engravings. Published by the American School of Correspondence of Chicago, and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price, —.

The book is thoroughly what it purports to be—a cyclopedia of telephony and telegraphy. The very brainiest men in American engineering adorn its list of experts employed in the compilation of data contained winthin its pages. In spite of the fact that America's foremost engineers have contributed to its pages the real object has never been lost sight of—that of explaining in a clear, simple, precise manner the workings of the great telephone and telegraphic art. The book is indispensable for those engaged in the telephonic or telegraphic profession and who desire a clear, simple and exhaustive treatment of the subject.

Electric Traction and Transmission Engineering. By Samuel Sheldon and Erick Hausman. Size 5½ x 7½ inches; 307 pages; 127 illustrations; clear type; cloth binding. Published by D. Van Nostrand Company, of New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $2.50.

The authors of this book are well known both to the technical educational world and those interested in affairs practical. The book is ambitious in its scope, attempting to cover a complete railway installation, from the cars to the power station, to indicate the nature and sequence of the various entailed problems, and to suggest or illustrate methods for their solution. Illustrative examples are solved and a list of problems appended at the end of each chapter. The book covers a field hitherto touched upon in separate details only. It combines steam-turbine installation along with the electrical problems. The recent impetus given to installation of central station steam auxiliaries on the Pacific Coast will make the book useful to Western engineers.

INDUSTRIAL

PROTECTIVE RESULTS ACCOMPLISHED BY ARCING RINGS ON TRANSMISSION LINES.

During the early part of this year, a very interesting paper was read before the American Institute of Electrical Engineers at Charlotte, North Carolina, describing a 60,000-volt transmission line of the Niagara, Lockport and Ontario Power Company. The paper dwelt particularly upon the remarkable amount of protection the transmission line had received by applying metal arcing rings to the insulators as illustrated in Figs. 1 and 2.

Fig. 1. High Tension Insulator Equipped With Arcing Ring.

These rings save the insulator from injury when the transmission line is struck by lightning, which is usually followed by the consequent flashover arc. They are placed in such a position as to attract the arc and hold it sufficiently removed from the porcelain to prevent breakage from the heat engendered. The puncture of the insulators is also prevented by the rings without their lowering the effective insulation of the line. During the season of 1910, which was a severe one, practically 410 miles of the transmission line above referred to was equipped with arcing rings. Comparing

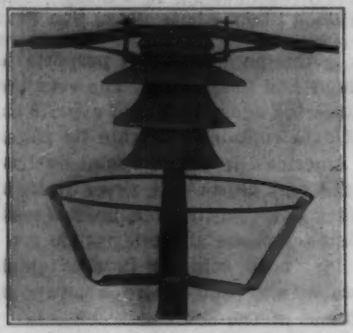

Fig. 2. Protected Insulator on Top Wire.

this season to that of 1908, both of which were severe, a good conception of the effectiveness of the protective measures adopted is shown. In 1908, 220 insulators were destroyed; 31, it was determined, from direct lightning strokes, judging from the characteristic manner in which they were broken up, 114 were punctured and 81 were destroyed by power arc following flashovers. In 1910, 26 insulators were lost; 17 by direct stroke and 9 by puncture. None were destroyed by power arcs on either line and none by puncture on the re-insulated line. The loss by direct stroke was practically equally divided between the lines.

These results show that the destruction of insulators by power arcs has been eliminated. That sound insulators protected by arcing rings fail only by direct lightning stroke and that arcing rings greatly reduce the tendency to puncture by induced potential effectiveness and do not prejudice the effective installation of the line.

The Locke Insulator Company have taken over all the patent rights of the arcing ring device shown in Figs. 1 and 2 and will handle their entire commercial development.

H. W. JOHNS-MANVILLE COMPANY'S EXHIBIT.

H. W. Johns-Manville Company of New York City, are making an unusually complete and interesting exhibition of J-M Products for Electric Railway Service at the American Electric Railway Association Convention at Atlantic City, N. J.

Among the many J-M railway products exhibited, the following are especially worthy of note:

J-M Fibre Conduit, which is manufactured in two styles known as Bell Joint and Straight Joint Type, together with complete line of fittings consisting of elbows, tees, crosses, junction boxes, etc.

The J-M Linolite System of Lighting is employed in illuminating the company's exhibit, and this mode of lighting is now widely used for show windows, show cases, sign lighting and indirect illumination because of its distribution of light and the marked economy in current consumption.

A complete line of Overhead Trolley and Transmission Line fittings which include many improvements and refinements recently made, is one of the features of the J-M exhibit and attracted a great deal of attention and interest.

Some interesting specimens of J-M Transite Ebony Asbestos Wood are also displayed.

"Noark" Car Fuse Boxes in various sizes occupy a prominent place in the exhibition and a complete line of "Noark" National Electrical Code Standard Protective Devices such as Fuses, Cutouts, Service Switches and Fuse Boxes are also well represented.

A new soldering paste which combines solder and a non-corrosive flux contained in a collapsible tube was also shown, known as "Solderall." J-M Friction Tapes and Splicing Compounds which are made in many grades to suit all conditions were well represented.

NEW LONG LIFE FLAME ARC LAMPS.

The new Type "K" long life flame arc lamps now being placed on the market by the General Electric Company are

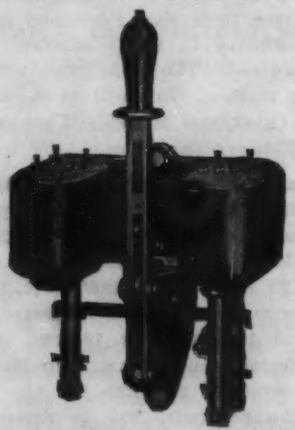

Fig. 1. G. E. Motor Circuit Direct Current Long Life Flame Arc Lamp. Mechanism.

available in four styles—K-28 for operation on series alternating current, K-36 on multiple alternating current, K-51 on multiple direct current, and K-43 on power circuits, of all commercial voltages.

The mechanism is of the focusing type, automatically maintaining the arc in the same position, thus affording a

constant and even distribution of light. A clutch of ingenious design permits the use of carbons varying considerably in diameter, and obviates all pick-up troubles due to clutch wear, thus insuring a perfect feed. The chain wheel is made of alloy with separate grooves for the upper and lower carbon holder chains. As the upper chain unwinds the lower winds, thus keeping the arc always in the same position. The cores and coils are suspended by means of compression springs to prevent any flickering of the arc when the lamps are hung in places subject to vibration. Except in the series lamps no shunt spools are used, thus eliminating a prolific source of arc lamp complaints.

of the upper carbon cut off to the proper length in the lower holder, and replace the globes. The necessity for using only one new carbon at a trim greatly reduces the cost of maintenance, while the homogeneous structure of the carbons affords many advantages over the cored type. The size of the carbons—⅞ inch diameter, 14 inches long—gives great mechanical strength and decreases the breakage in handling.

The principle of ventilation applied allows the hot gases rising from the arc to circulate through the condensing chamber where they are cooled and the fumes condensed and deposited, thus keeping the inner globe clean and the illumination unimpaired. The casing is made of either copper or

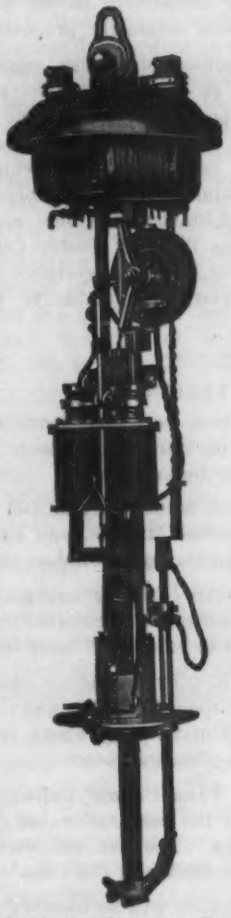

Fig. 2. G. E. Multiple Alternating Current Long Flame Arc Lamp. Mechanism.

Fig. 3. G. E. Multiple Direct Current Long Life Flame Arc Lamp. Mechanism.

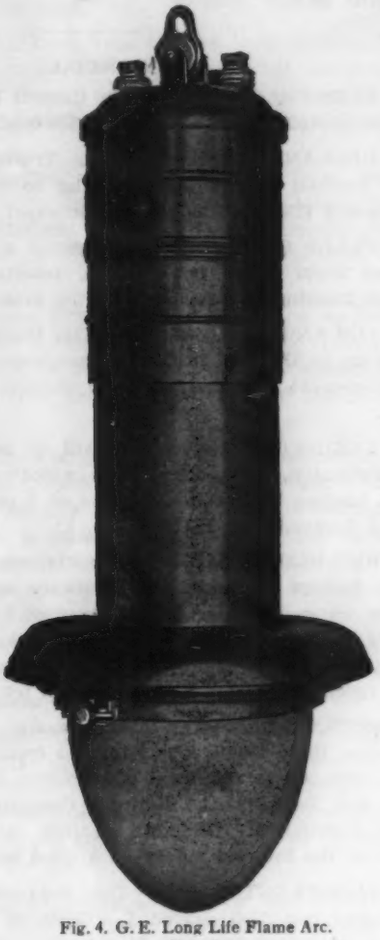

Fig. 4. G. E. Long Life Flame Arc. Exterior.

The lamps are provided with two globes. The inner globe may be of either clear or opalescent glass. Its open end is ground smooth and makes an air-tight joint with the machined surface on the under side of the condensing chamber against which it is held by a phosphor bronze bail spring. The outer globe is furnished in opalescent glass on the standard lamps, but may be obtained in clear glass. The method of holding the outer globe greatly simplifies the operation of trimming. The complete globe holder is hinged to the condensing chamber, a retaining spring holding the outer globe in position uniformly and without pressure. To lower the outer globe for trimming it is only necessary to loosen the wing-nut provided and allow the globe to swing downward where it is out of the way. This arrangement obviates the necessity for removing the globe, thus preventing the liability of its swinging in the wind and breaking by striking against the pole. The lamps may be used without the outer globe.

To trim, it is only necessary to lower the outer globe, take off the inner, remove the stub of the upper carbon, press the new upper carbon firmly in the spring holder, insert the stub

steel and is of the telescopic type to permit the ready examination of the entire lamp mechanism for adjustment or repairs without removing the condensing chamber or globes. The dome is a steel punching possessing great mechanical strength.

The arc voltage on the multiple alternating current lamp is regulated by a reactance, on the multiple direct current lamp by a resistance, and on the power circuit lamp by a resistance and a weight for properly balancing the arc voltages when two lamps are burning in series. In all the lamps the respective reactances or resistances are located within the lamp casing. The clutch rod regulates the distance from the top of the armature to the clutch lever, the proper arc pick-up being between ⅞ and 1⅛ inches.

The series alternating-current lamp has an efficiency of .24 watts per mean hemispherical candlepower, and the multiple alternating-current and multiple direct-current lamps have efficiencies of .28 and .41 watts, respectively. The series lamps have a life of 90 to 100 hours, the multiple lamps 100 to 120 hours, thus combining high efficiency with long life.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—The Sunset Beach Gas & Electric Company has been incorporated for $25,000 by C. W. Gower, F. W. Norman and H. Pierce.

VISALIA, CAL.—The Central Counties Gas Company has been incorporated for $500,000, by F. H. Hess and H. W. Ritz of Porterville, N. F. Jamieson, M. Hesselberger, and C. F. Ritz of Los Angeles.

FINANCIAL.

EUGENE, ORE.—The City Council has passed an ordinance providing for the sale of $25,000 of electric light bonds.

REDLANDS, CAL.—The City Trustees will call a special election at the next meeting to submit the question of issuing $750,000 bonds for a municipal water system.

FALLS CITY, ORE.—The special election on the additional $5000 water bonds issue, resulted in favor of the issue, insuring the extension of the present water system.

LOS ANGELES, CAL.—The City Clerk will receive sealed bids up to October 23 for the purchase of $520,000 Harbor Improvement Bonds and $525,000 Electric Plant Bonds of the city.

YERINGTON, NEV.—Bids will be received by the City of Yerington, Nev., for $36,000 waterworks bonds of said city, bearing interest at the rate of 6 per cent per annum; dated September 1, 1911.

RED BLUFF, CAL.—The Supervisors of Tehama County have decided to cancel the insurance of the bridge at Tehama across the Sacramento River of $43,000 and install a water system for the protection of the bridge from fire. County Surveyor Luning has been ordered to prepare plans and specifications for a water system for the bridge.

FRESNO, CAL.—The interest money, amounting to a little over $2500 which was expected from the Hudson Counties Company to pay local bondholders in the Fresno, Hanford and Summit Lake Railroad Company, has arrived and been distributed. Directors of this railroad take the receipt of the interest money as a good omen.

SACRAMENTO, CAL.—The Sacramento Natural Gas Company has filed amended articles of incorporation with the county clerk in which it announces its determination of entering into a bonded indebtedness of $400,000 to be used in extending its business and supply system and to pay off present and future debts. This step was decided on at a meeting of the directors and stockholders on August 28.

OAKLAND, CAL.—After several months of conference F. A. Leach Jr., manager of the Oakland Gas Light and Heat Company, informed Mayor Mott in Oakland Saturday that his concern had agreed to reduce its rates. Beginning on November 1, Leach said, the company would make a maximum rate of 90c for gas for all purposes, with a sliding scale, making the minimum rate 75c per thousand cubic feet for gas in large quantities. The existing rates are 90c per cubic foot for fuel purposes and $1 for illuminating purposes.

LOS ANGELES, CAL.—In a message to the City Council the Mayor said that he endorsed the recommendation of the Board of Public Service to submit to the voters the question of issuing bonds for providing an electric distributing system. He also recommended that the bonds for a municipal railway be submitted to the voters at an early day. The latter part of his recommendation received little attention, but the proposal, which calls for issuing $5,500,000 in bonds, with regard to distributing the electric power that is to be generated from the aqueduct, was referred to the finance committee. The city clerk was directed to advertise for bids for $520,000 worth of harbor bonds and $525,000 worth of aqueduct power bonds, the total issue of which is to be; harbor bonds, $3,000,000, and aqueduct power bonds $3,500,000. By going into the open market with these bonds, the use of the sinking fund for investment in the bonds is not followed at this time, as was originally proposed.

PORTLAND, ORE.—Nine million of British capital will be available in Portland within 90 days for the development of the great individual power project in the Pacific Northwest. The money is to be used for the construction of huge dams at the Deschutes River, near its mouth, which will be capable of developing a minimum of 75,000 horsepower, This will be done at a cost of $7,500,000. The new syndicate will be known as The Deschutes Rimrock Power Company, and is being capitalized at $1,000,000. Its president will be Malcolm A. Moody. The secretary and treasurer will be Leroy Park.

TRANSPORTATION.

REDLANDS, CAL.—The street car line from Orange street via east Colton avenue, to University street, is now assured. Operations will begin immediately.

PACIFIC GROVE, CAL.—The Monterey and Del Monte Heights Railway is to be completed at once, and cars will be running out to Del Monte Heights by December 15th.

ABERDEEN, WASH.—The City Council has granted a franchise to the Grays Harbor Railway & Light Co., in which the company is given permission to extend its local tracks.

PACIFIC GROVE, CAL.—H. R. O'Bryan and his associates are preparing to construct a railroad from Broadway in the Del Monte Heights tract to the Hot Springs, where they are making arrangements to erect a pleasure resort.

BUHL, IDAHO.—The Twin Falls County Railway Company has received a franchise for the construction of an electric road here and in the vicinity. The line will eventually traverse the entire district in this section of the state.

SEDRO-WOOLLEY, WASH.—Bids will be received by the State Board of Control up to November 6 for the erection of a concrete and steel power house, also for mechanical equipment, boilers, engines, etc., to be installed in the power house.

RAYMOND, WASH.—The Twin City Electric Railway, now being built between Raymond and South Bend, received its first car of steel rails, which will be laid at once. The company expects to have the line in operation by January 1.

SAN JOSE, CAL.—C. P. Anderson has applied to the Supervisors for a franchise to operate by gas or electricity a standard gauge railroad in the County of Santa Clara. Bids will be received up to 10 a. m. November 4. H. A. Pfister, clerk.

SACRAMENTO, CAL.—Word has been received here that President T. T. C. Gregory of the Sacramento-Woodland Railroad has let contracts for construction work on two sections of the road. The Dozier Construction Company has been awarded the contract for that section of the line between Woodland and Elkhorn, while Cooper & Hawley are to handle the construction of another section. Work will start next week. Bids will soon be called for on the bridge trestle 10,000 feet long across Yolo basin.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will erect a $1250 steel tower at the foot of Virginia street, 26x26 by 85 feet high, also a $2500 steel tower on the opposite of the Willamette River on River Front street, 27x27 feet, 100 feet high.

SAN DIEGO, CAL.—The management of the San Diego Electric Railway Company announces that extensive improvements will be made here. Pay-as-you-enter cars will be put in service. The company will also extend lines and double track lines that are now single track.

SAN BERNARDINO, CAL.—The Southern Pacific Company will build an electric line from Redlands to Yucaipa Valley instead of constructing the new main line from Beaumont to Redlands, through Eucaipa. This will be a portion of the San Bernardino Division of the Pacific Electric.

SEATTLE, WASH.—The Board of Public Works has approved plans as prepared by the city engineer for the construction of a municipal street railway from Steward street to Thorndyke and Twelfth avenue. After a few details have been adjusted the Board of Public Works will issue a call for bids on this section.

SAN FRANCISCO, CAL.—Mayor McCarthy has approved the resolution passed by the Supervisors rescinding the temporary permit of the Geary Street, Park and Ocean Railway to operate its cable cars and directing it to stop running in 14 days. The last day for the operation of the old cable road will, therefore, be October 19.

OAKLAND, CAL.—A deed has been placed on record conveying 2200 acres of land in and around Newark, in Alameda County, to the United Properties Company, owners of the Key Route. The Newark Development Company, of which Harvey M. Toy is president and sole owner, is the seller of this land. The price paid was about $600,000.

LAKEPORT, CAL.—The directors of the Clear Lake Railroad have authorized the construction of nine miles of roadbed, four miles out of Hopland and five miles southwest of Lakeport. The company is capitalized at $500,000 to build from Hopland to Lakeport, a distance of 24 miles, with branches through Kelseyville and Upper Lake.

OAKLAND, CAL.—With the purchase of the Chris Jessen property at Oakland and Peralta avenues, the Key Route secured the last link in its right of way between Oakland and San Jose. Within two weeks, it is understood, active construction work on the new line will commence as necessary surveys have been completed and material ordered.

WENATCHEE, WASH.—The Wenatchee Traction Company has been granted a franchise for the construction of an electric railway on certain local streets. The sum of $5000 has been deposited to guarantee construction within six months. The line will be built along the Columbia river valley, it is reported, with extensions to make a total distance of 100 miles. Date of receiving bids on above has been extended from October 16 to November 6.

ILLUMINATION.

POMEROY, WASH.—E. M. Rauch has made application to the City Council for a franchise to operate a gas plant for 25 years.

ABERDEEN, WASH.—The Council is discussing the question of establishing a light plant to be owned and operated by the city.

COLTON, CAL.—The City Council passed an ordinance authorizing the president of the Board of Trustees and the city clerk to execute a certain contract with the Southern California Edison Company for lighting the streets of the city.

ELLENSBURG, WASH.—This city will install cluster lights along the principal streets the coming spring.

WATTS, CAL.—An ordinance granting a fifty-year franchise to the Pacific Light & Power Company has been carried unanimously.

FULLERTON, CAL.—The city has signed a contract for a term of five years with the Southern California Edison Company for an improved system of street lamps, which will be installed at once.

ALHAMBRA, CAL.—The Board of Trustees has discussed the proposed ornamental lighting system for North Marguerita avenue, and it was agreed that 12 posts be installed with three lights each.

LOON LAKE, WASH.—Gehrke & Sons, local millers, are making a canvass of the town to ascertain what patronage can be secured for an electric lighting system and state if as many as 200 lights can be secured they will install an electric plant.

VALLEJO, CAL.—The residents of the O'Hara tract are to have electric lights and power. Manager Albert Casper of the Vallejo Electric Light & Power Company, has announced that he intends to run a pole line to the tract immediately.

PERRIS, CAL.—The City Council has passed an ordinance granting to Fred B. Mechling a franchise to maintain, for a period of 50 years, an electric pole and wire system for transmitting electric light, heat and power along the public streets of this city.

CORVALLIS, ORE.—Col. Wm. Hamilton McGoldric wants to install a modern gas, light, heat and power plant in Corvallis and has asked the City Council for a 50-year franchise, agreeing if the same is granted to have the plant in full operation by December 31, 1912.

SAN BERNARDINO, CAL.—If a sufficient number of residents of Rialto District will agree to use gas as soon as the system is installed in that community, Manager Grow of the Southern California Gas Company, says they will agree to have the system in operation by Christmas.

SPOKANE, WASH.—Commissioner Fasset has recommended favorably on the petition of Second avenue property owners for the installation of electroliers along the avenue. An improvement district will be created to defray expenses of the electroliers and the city will pay a portion of maintenance cost.

MILL VALLEY, CAL.—The Mill Valley Gas Company, which was organized recently, has received its first shipment of pipe and the company is now engaged in placing it along the streets of the town. The company promises to supply gas to consumers by February 1, 1912. The Pacific Gas & Electric Company intends to supply Mill Valley with gas the early part of the year.

TELEPHONE AND TELEGRAPH.

ASTORIA, ORE.—The Centennial Telephone Company, which has been organized for the purpose of constructing a telephone line from this city to Jewell and Elsie, has awarded a contract to Damon Stinson for stringing the wire for the proposed line.

PORTERVILLE, CAL.—Residents of the Worth district of the upper Tule have organized an independent telephone company, to be known as the Rosedale Rural Telephone Company. The officers are: A. Chalmers, president; E. O. Giddings, vice-president; M. Giddings, secretary, and J. E. Reilly, treasurer. C. H. Weed and Peter Von Ting are the other members of the board of directors. Work is to start

at once on a line to run from this city to Worth, on the south side of the river, including the orange groves of the Worth district, and returning to Porterville on the north bank of the river.

TRANSMISSION.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company has advised the City Council of Berkeley that it is preparing to establish a plant in Berkeley.

The Taylor Chemical Company, Penn Yann, N. Y., have ordered from the General Electric Company one 625 k.v.a horizontal turbo-generator, one 7 kw. 125 volt horizontal turbo generator, two 250 k.v.a. transformers and a switchboard.

BEND, ORE.—The Council has passed an ordinance authorizing giving the Bend Water, Light & Power Company the right to construct a system of poles, wires in the alleys and public ways of the city for the purpose of furnishing light and power to citizens of the city.

BOISE, IDAHO.—It is reported that the Kuhns of Pittsburg, who recently secured a power franchise in South Boise, will shortly apply for a franchise in this city. It is also rumored that the Beaver River Power Company will also endeavor to secure a franchise here.

VANCOUVER, B. C.—The Western Canada Power Company has acquired a site on Powell street, near the yards the British Sugar Refinery Company for the immediate erection of a building to be equipped in time to receive power from the company's hydroelectric plant at Stave Falls. A warehouse will also be erected on the property.

VANCOUVER, B. C.—It is reported that the Canadian Pacific Railway has acquired a water power site on the Adams river. The Adams river, which flows out of Adams lake, is capable of developing 10,000 h.p. between the lake and its confluence with the South Thompson River. The railway acquired the power site in connection with its intention of electrifying a portion of its line in the mountains.

PORTLAND, ORE.—Engineers representing the Pacific Power & Light Company of this city are preparing to go into the field to make surveys for a high power transmission line between Walluia and The Dalles for the purpose of serving electricity to the territory between these places. The line is to be 130 miles long and to cost $375,000, and built to carry a heavy load at 66,000 volts. As soon as the surveys are completed material will be ordered.

SACRAMENTO, CAL.—The Pacific Coast Gas and Electric Company has started work in the northern part of the city on the new steam relay station. Dredging and piledriving are under way and work will be pushed on the early installation of a 5000-kw., horizontal Curtis steam turbine generating set. Stirling boilers, with auxiliary apparatus will be installed for an ultimate capacity of 12,500 kw. A 7500-kw. horizontal Curtis turbine is on delivery and will be installed later. It is the company's intention to give Sacramento the best service possible.

STOCKTON, CAL.—The Sierra & San Francisco Power Company has entered the local field. H. Jackson, assistant manager of the company, states that his workmen have started the work of extending their lines from Manteca to Stockton. He says: "The Sierra and San Francisco Power Company is in no way connected with any other corporation. We have a capitalization of $20,000,000 and backing to the exent of $10,000,000. We will expend not less than $200,000 in Stockton, which will include an auxiliary plant to protect our patrons in case our hydroelectric plant on the Stanislaus River should fail temporarily."

WATERWORKS.

WAPATO, WASH.—The City Council has passed an ordinance providing for the sale of municipal water bonds to defray the cost of the construction of a municipal water system.

GRANGER, WASH.—Town Engineer N. W. Avery has been instructed by the Town Council to prepare the plans and specifications for a modern water works system for Granger.

WOODLAND, CAL.—The contract for the boring of another city well has been awarded to Bender Bros. of this city. They will receive $5.50 a foot for the first 70 feet and $3.75 a foot from 70 feet to 200 feet.

BRIDGEPORT, CAL.—The firm of Fairbanks, Morse & Co. has been awarded the contract to install the water system at the court house for the sum of $3323, including all charges for the freight on supplies, machinery, etc.

BEND, ORE.—Th City Council has passed an ordinance authorizing the Bend Water, Light & Power Company to construct and operate a water system for the purpose of furnishing and supplying water to the public of that city.

ELMA, WASH.—By an overwhelming majority the Wenzell, Wash., Springs water proposition, and the issue of ten thousand dollars in bonds for the extension of the present water system were endorsed by the people of Elma.

SIERRA MADRE, CAL.—The City Trustees have adopted the special election ordinance for an election to be held November 7 to vote on the question of issuing $111,000 bonds for the purchase of the property of the Sierra Madre Water Company, and for development of more water.

KLAMATH FALLS.—The electric lighting service of the local company, which was recently put out of service for some hours by a wind storm that blew the water out of Link River into the Upper Klamath Lake and also caused short circuiting of the lines, is again in perfect working order. George J. Walton is general manager of the company.

BARSTOW, CAL.—The Westwater Power Company has sold its holdings to the Arrowhead Reservoir & Power Company who now hold most of the water in the Mohave River. This company will erect a power plant at the head of the river and furnish power for the valley and desert.

ELLENSBURG, WASH.—According to Samuel Kreidel, chairman of the council's special water commission, an ordinance will be passed making Ellensburg a special improvement district, bonded to pay for the recently authorized $150,000 municipal water works. The water works will be erected near the county poor farm, seven miles north of town and preparations for securing the right of way for the pipe line to the city are well underway.

FORTUNA, CAL.—The stockholders of the Fortuna Water Company are preparing to sink a well with a sufficient flow of water to meet the requirements of this fast-growing city. A committee, comprising F. A. Leach, L. C. Morgan and A. C. McArthur, have been named to select a site for the well that in their opinion would furnish the required flow of water.

WHITTIER, CAL.—After hearing from the water superintendent on the matter of improving the water conditions in the vicinity of the college, the City Aldermen decided that a four-inch main is necessary. Work will be started at once laying the pipe from the large main which hits the city limits on East Philadelphia street. A pipe line will be run along the city limits.